2019

Executive Capacities for Students Diagnosed with Attention Deficit Hyperactivity Disorder and Learning Disability

Kate Boccella-Perras
Philadelphia College of Osteopathic Medicine

Philadelphia College of Osteopathic Medicine

Department of Psychology

EXECUTIVE CAPACITIES FOR STUDENTS DIAGNOSED WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER AND LEARNING DISABILITY

Kate Boccella-Perras

Submitted in Partial Fulfillment of the Requirements for the Degree of

Doctor of Psychology

May 2019

Dissertation Approval

This is to certify that the thesis presented to us by _____ on the _____ day of _____, 20___, in partial fulfillment of the requirements for the degree of Doctor of Psychology, has been examined and is acceptable in both scholarship and literary quality.

Committee Members' Signatures:

_____, Chairperson

_____

_____

_____, Chair, Department of Psychology

ACKNOWLEDGEMENTS

Over the course of my education, I have had the privilege of meeting countless teachers, coaches and mentors that have guided me to think autonomously and encouraged my love of learning. One of the most inspirational enthusiasts of learning that I have met throughout my educational career is my dissertation chair and higher education professor, Dr. George McCloskey. Thank you for inspiring me to continue to learn, to question the boundaries of school psychology, and most importantly to identify methods that allow all children to access their highest potential. Dr. McCloskey, your vigilant guidance and support through each stage of the writing process has made this dissertation possible.

It is also crucial that I thank my committee members, Dr. Jessica Kendorski and Dr. Lori Lennon, for their flexibility, support, time, and kindness throughout the dissertation process. The mentorship from both of you has enhanced my doctoral program experience and has allowed me to access this level of achievement.

To my parents, I cannot thank you enough for the unconditional love and support that you have always provided for me. You have dedicated your lives to improving the lives of others. It is inspirational and I am thankful to have such intelligent and compassionate role models. Mom, your attainment of your doctorate and lifelong commitment to learning encouraged me to pursue my doctorate of school psychology. You are my mentor, the compass to my ethical dilemmas, and my fiercest supporter. Dad, your career in school psychology and dedication to helping children and families encouraged me to pursue a similar path. You taught me the skills that allowed me to pursue my doctorate of school psychology. From the many hours of working through math homework at the kitchen table to your unwavering kindness and patience

throughout my childhood; you taught me how to be dedicated, loyal, and to work hard. I am forever grateful for both of you.

A special thanks to my sister, Jayne, who has kept me laughing since she was old enough to talk. You have been one of the greatest joys in my life and you constantly inspire me to live more sincerely. Thank you for keeping me sane.

I also want to thank my family and friends for the wonderful support and encouragement throughout my education and career. I want to express my sincere gratitude to the members of the Boccella, Perras, and Loux families who have provided constant love, advice, support, family dinners, and motivation that encouraged me to keep working throughout this difficult process. Thank you to the members of my PCOM cohort. I would not have made it without you. Thank you to my good friends, you know who you are, who always help me find peace and happiness throughout any challenge I am facing.

I want to thank my best furry friend, Bernadette BPL, for constantly sitting by me throughout research, writing, editing, and more editing of this dissertation. You make me smile every day. I cannot be more thankful for such a sweet dog.

Finally, I want to express my sincere appreciation and gratitude to the love of my life and best friend, Kevin Loux. Since I met you ten years ago, you have opened a part of my heart that I didn't know existed. You have brought me balance and peace of mind with your nonjudgmental attitude, wise insight, and dedication to pursuing happiness. Thank you for the countless clean dishes, laundry, foot massages, dinners, and pep talks. Thank you for loving me when I felt defeated. You helped me get through this doctoral program in the most positive way.

ABSTRACT

All students in this study were rated by teachers with the McCloskey Executive Function Scale (MEFS) to identify executive function deficits (EFDs; not knowing when) and executive skill deficits (ESDs; not knowing how). Significantly larger proportions of students in the ADHD-diagnosed (ADHD) group than in the matched control group were rated by teachers as having either an EFD or an ESD within all seven self-regulation clusters, with more deficits identified within the Academic Arena than within the Self/Social Arena. In contrast, significantly larger proportions of students in the LD-classified (LD) group than in the matched control group were rated by teachers as having an EFD for only a few items (2%) within the Academic Arena of the Engagement Cluster and only a few items (15%) within the Self/Social Arena distributed across the Engagement, Efficiency, Memory and Inquiry Clusters. However, significantly larger proportions of students in the LD group than in the matched control group were rated by teachers as having an ESD for 37% of the items within the Academic Arena distributed across the Optimization, Efficiency, Memory, Inquiry and Solution Clusters, but for no items within the Self/Social Arena in any self-regulation cluster. Additionally, significantly larger proportions of students in the ADHD group than in the LD group were rated by teachers as having an EFD in the case of only 7% of the items within the Academic Arena distributed across the Engagement and Optimization Cluster, and only 9% of the items within the Self/Social Arena of the Optimization Cluster. No significant differences were found between the ADHD and LD groups for teacher ratings of EFDs within the Academic Arena, and significant differences were found for only 7% of the items within the Self/Social Arena distributed across the Optimization and Memory Clusters. Significantly larger proportions of the LD group than the ADHD-diagnosed

group were rated by teachers as having an EFD for only 5% of the items within the Self/Social Arena distributed across the Efficiency and Memory clusters.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Overview

The current study strives to provide a comparative analysis of executive functioning within specific disability samples in comparison to matched control samples. The study will examine executive functioning of students diagnosed with Attention Deficit Hyperactivity Disorder and students diagnosed with a Specific Learning Disability. The study will hypothesize specific executive dysfunction within each population. The research is intended to contribute to identification and diagnosis of executive dysfunction for students classified with Attention Deficit Hyperactivity Disorder versus students with a Specific Learning Disability. Assessment of executive functioning within various disability samples may help improve accuracy of diagnosis and target specific interventions within special education programming.

The study will also compare executive functioning skills within both disability populations to executive functioning skills of students matched on demographic variables and without an identified disability. There may be potential overlap of executive dysfunction within all populations. The study may help identify evidence to guide research-based school-wide executive functioning interventions within the general education program. A school-wide executive functioning intervention that can target areas of need for all populations may increase the success of educating students with disabilities in the least restrictive environments.

Introduction

In the United States of America, it is the law that every child is provided with equal opportunities for a free and appropriate education (IDEA, 2004). Individuals diagnosed with

disabilities are entitled to an appropriate education. In 1975, the Individuals with Disabilities Education Act (IDEA, 2004) enforced a free and appropriate public school education for eligible students with disabilities ages 3–21 that meets unique needs.

The National Center for Education Statistics (NCES) is the primary federal entity for collecting, analyzing, and reporting data related to education in the United States and other nations (McFarland et al., 2018). As of the 2015 to 2016 school year, the number of students deemed eligible for special education supports and services increased to 6.7 million children (McFarland et al., 2018). This number constitutes 13 percent of total public school enrollment. Nearly half of all students with an educational disability are classified with a Specific Learning Disability (SLD) or Attention Deficit Hyperactivity Disorder (ADHD) (McFarland et al., 2018). Students diagnosed with specific learning disabilities represent 34% of students receiving special education services. The Diagnostic and Statistical Manual of Mental Disorders (DSM-5, 2013) states that 5% of all children in schools have ADHD. However, other studies in the US have estimated higher rates in community samples. The Center for Disease Control and Prevention (2018) reported that approximately 9.4% of children 2-17 years of age (6.1 million) have been diagnosed with ADHD.

Individuals diagnosed with specific learning disabilities and ADHD constitute approximately 48% of all students in special education (McFarland et al., 2018). There are an increasing number of students with SLD and ADHD educated in the general education classroom. According to the National Center for Educational Statistics, approximately 70% of students with specific learning disabilities and 65% of students with ADHD spend most of the school day in general education classes (McFarland et al., 2018). Therefore, general education

teachers are frequently responsible for providing an education to a classroom of students with neurodiversity.

Students with or without educational disabilities can present with executive functioning deficits in the classroom. Executive functions are defined as one's ability to cue their brain's neural networks to initiate functions related to higher order processes (McCloskey, Perkins, & Divner, 2009). Executive functions (EF) are skills that can be assessed and measured to identify a student's reasoning, problem solving, organization, planning, working memory, behavior regulation, and self-monitoring as well as the ability to focus and sustain attention (Miller, 2013). EF deficits can negatively impact perceptions, emotions, thoughts, and actions (McCloskey et al., 2009).

Although executive skills and functioning are vital to productivity and generation, executive dysfunction is not a disability category recognized within the field of special education. It is also not a disability category recognized by the American Psychiatric Association (2013) or in the latest DSM-V. It is crucial to identify executive functioning skills and deficits within recognized clinical and educational disability categories to create effective interventions to address the underlying neurocognitive weaknesses that manifest into disabilities; such as, the exhibition of SLD and ADHD. Educators and diagnosticians should also examine and identify the specific, causal executive functioning needs of students with neurological differences to increase accurate diagnosis of students with neurodevelopmental disorders and to increase the success for all students learning in neurodiverse classrooms.

Statement of the Problem

Academic success is increasingly linked to mastery of executive functioning processes; such as, goal setting, planning, prioritizing, organizing, shifting, flexibility, holding/manipulating

information, and self-monitoring (Meltzer, 2010; McCloskey et al., 2009; Miller, 2013). Youth identified with SLD and ADHD have heighted risk for poor executive functioning (Barkley, 2015). Executive functioning deficits can lead to difficulties with: academic achievement, school exclusion, school refusal, and grade repetition (Barkley, 2006; Purdie, Hattie, & Carroll, 2002). Educational psychologists can assess and identify individual executive functioning skills to help improve learning and behavioral outcomes for at-risk student populations. Identification of specific executive functioning needs of students with Attention Deficit Hyperactivity Disorder, students with a Specific Learning Disability, and students with no identified disability may help improve educational planning and interventions for all students. Clinicians need to improve their understanding of executive capacity deficits associated with these disorders, given the significant impact on academic, social and cognitive growth and development of these individuals. Students within each of these populations may have unique executive functioning needs or there may be overlap of executive functioning deficits. The information can be used to design interventions that target multiple student populations within the special education and regular education programs.

Purpose of the Study

The purpose of the study is to examine the executive capacity (EC) profiles of students with SLD, ADHD, and neurotypical students in order to analyze the similarities and differences between the three populations. Within the school-based setting, individuals with ADHD and SLD often present with difficulties regarding their behavior, academic achievement and emotional functioning (Miller, 2013). However, the diagnosis of students with SLD and ADHD is not a reliable process across the United States of America. Analysis of the executive capacities of students who are previously diagnosed with SLD or ADHD may help further clarify the

criteria for diagnosis. Students with ADHD and SLD are increasingly educated in the regular education program. Viewing these difficulties through the lens of specific patterns of executive functioning strengths and deficits may help to identify specific treatment methods that can be used to assist these students and neurotypical students with academic achievement and daily functioning. While there may be similar executive functioning strengths and weaknesses between students diagnosed with SLD and students diagnosed with ADHD, there may be differences that could have significant implications when selecting or developing effective treatment methods.

The current study will examine teacher ratings of the executive capacities (ECs) of a group of students diagnosed with SLD and the teacher ratings of the ECs of a group of students diagnosed with ADHD to identify similarities and/or differences in patterns of EC strengths and/or weaknesses. The teacher ratings of these clinical groups also will be examined in contrast to the teacher ratings of demographically-matched control samples of non-clinical students to identify similarities and/or difference in patterns of EC strengths and/or weaknesses. Conclusions drawn from the data analyses will aid in refining the selection of treatment methods and interventions that are used to address academic and social/emotional difficulties exhibited by students diagnosed with SLD or with ADHD.

CHAPTER 2

LITERATURE REVIEW

The construct of executive function has been developed to define the neurological processes that act in a coordinated manner to engage in purposeful, organized, self-regulated, and goal-directed processing of perceptions, emotions, thoughts, actions, and knowledge bases (McCloskey, Perkins, & Divner, 2009). The term was originated by observations of individuals that suffered damage to the prefrontal region of the brain. These individuals reportedly exhibited inattention, poor regulation of emotions, motivation, and disorganized action and strategies to complete a task (Goldstein, Naglieri, Princiotta, & Otero, 2013; Fuster, 1997). However, these individuals continued to perform well on assessments of memory, language, learning, and reasoning (Goldstein, et al., 2013). Individuals with frontal lobe damage revealed that there is a system in the human brain accountable for cuing and coordinating cognitive processes.

The professional literature conveys that executive functioning is not an overarching term that represents a singular cognitive control process (McCloskey, Perkins, & Divner, 2009). Alternatively, executive functioning is comprised of many independent and coordinated executive capacities that cue mental processes. Executive functions are comprised of many neural networks, and it is common for all individuals to have areas of well-developed executive capacities and areas that are less developed.

Individuals diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) and Specific Learning Disability (SLD) have significant executive functioning deficits (Barkley 2015; Alfonso and Flanagan, 2018). Individuals with ADHD demonstrate difficulty with focusing and sustaining attention, hyperactivity, and/or impulsivity (American Psychiatric Association, 2013). The diagnostic definition of SLD includes individuals that have average

intelligence with at least one significantly less developed psychological process (Alfonso & Flanagan, 2018).

Multiple concepts of executive functioning will be discussed in the following chapter. The relationship of EF to SLD and ADHD will be highlighted. Furthermore, the diagnosis of ADHD and SLD will be discussed in the following chapter to highlight the importance of executive functioning assessment.

Attention Deficit Hyperactivity Disorder

References of individuals that have problems with inattention and poor impulse control dates to the late 1700s (Taylor, 2011). The first description of attention disorders occurred in the medical textbook by Melchior Adam Weikard in German in 1775 (Barkley & Peters, 2012). Weikard described these individuals as inattentive, distractible, lacking in persistence, overactive, and impulsive. In 1902, George Still was widely accredited with the first medical description of ADHD due to his detailed accounts of symptoms and larger sample sizes. Still proposed that the "keynote" qualities of these children are immediate gratification of the self, heightened emotionality, and a defect in moral control. He noted that these behaviors are commonly presented in children with near-normal intelligence.

Neuroimaging research has revealed that Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder that is associated with abnormalities or developmental delays in brain functioning (DSM-5, 2013; American Psychiatric Association, 2013; Barkley, 1997). Currently, ADHD is a common and well-known behavioral disorder. It represents one of the most common reasons children with behavior problems are referred to medical and mental health clinicians in the United States (Barkley, 2015). ADHD is a disorder that causes individuals to present with hyperactive or impulsive behavior or to show a marked

decrease in the ability to focus and maintain attention. In some cases, individuals can present with a combination of both inattentive and hyperactive/impulsive behaviors.

The symptomatology of ADHD can negatively impact daily functioning across a variety of settings (American Psychiatric Association, 2013). ADHD is a construct that includes a diverse manifestation of symptoms, severity of symptomology, age of onset, and co-morbidity (Barkley, 2015). However, ADHD is commonly displayed in early development and to a degree that is excessive and inappropriate for the individual's developmental level. The symptoms are most evident when the individual is required to pay attention, restrain movement, inhibit impulses, and regulate their own behavior (Barkley, 2015). These neurocognitive deficits can negatively impact the individual's functioning when organizing behavior and ability to prioritize long-term over short-term consequences (Ardila, 2008).

The first serial developmental neuroimaging study of ADHD was able to calculate the degree of delay in brain maturation across brain areas associated with the disorder (Shaw et al., 2007). The prefrontal cortex showed the greatest magnitude of delay in development. These findings correlate with the concept that ADHD is a disorder of executive functioning. Most recently, neuroimaging called diffusion tensor imaging (DTI) can examine white matter tracts that connect cortical and subcortical structures. A meta-analysis of studies using DTI to examine participants with ADHD, revealed that white matter was significantly decreased in child, adolescent, and adult participants with ADHD; specifically with significant differences in the frontal, temporal, parietal and occipital lobes. (Barkley, 2015). The microstructural differences in adult ADHD may contribute to poor inhibition and greater impulsivity (Onnink, et al., 2015). Functional brain imaging studies have consistently shown that participants with ADHD have decreased blood flow to the prefrontal regions (particularly the right frontal lobe) and pathways

connecting these regions to the limbic system via the striatum and its anterior region known as the caudate, and the cerebellum (Hendren, DeBacker, & Pandina, 2000).

There is also a genetic contribution to ADHD. Parents of children with ADHD are two to eight times more likely to have the disorder than parents of control children (Bierdman, Keenan, & Faraone, 1990; Levy & Hay, 1992). The risk to the offspring is up to 57%. Additionally, 35% of siblings of children with ADHD also have the disorder. Adoptive studies demonstrate that hyperactive children are more likely to resemble their biological parents than their adoptive parents (Pauls, 1991).

Prevalence.

Reports from the CDC indicated that approximately 11% of children between the ages of 4 and 17 have been diagnosed with ADHD; based on parent report from 2011-2012. According to the same 2011-2012 report, there have been approximately 237,000 children between 2 and 5 years old diagnosed with ADHD in the United States. Reports from the DSM-5 indicate that ADHD occurs in approximately 5% of children and 2.5% of adults. Gender specific reports indicate that ADHD affects male children approximately twice as much as female children; this changed to a 1.6:1 ratio in adults (American Psychiatric Association, 2013).

Diagnostic criteria.

Inattentive Presentation.

ADHD can manifest in one of three ways; one of which is ADHD Predominantly inattentive presentation (ADHD-I). Individuals with this form of ADHD present with a high degree of difficulty in focusing and maintaining attention that negatively impacts social and academic/occupational functioning. To meet diagnostic criteria for ADHD-I, a minimum of 6 of

the following symptoms must be present for at least 6 months (American Psychiatric Association, 2013):

1. Failing to provide close attention to details or making careless mistakes on schoolwork or at work.
2. Difficulty sustaining attention in tasks or during play.
3. Seeming not to listen when being directly spoken to.
4. Failing to follow through on instructions and failing to complete schoolwork, chores or work place responsibilities.
5. Having difficulty in organizing tasks and activities.
6. Often avoids, becomes reluctant or dislikes tasks that require a high degree of sustained mental effort.
7. Loses items necessary for task or activities (e.g. school materials, personal items such as a wallet or telephone).
8. Often easily distracted by extraneous stimuli.
9. Often is forgetful regarding daily activities, such as appointments, completing chores, etc.

Hyperactive/Impulsive Presentation.

Another presentation of ADHD includes those who display a high level of hyperactive and/or impulsive behaviors (ADHD-H). Heightened activity level is most pronounced in low-stimulation environments, suggesting that the hyperactivity is a form of stimulation seeking (Barkley, 2015). These individuals can display a variety of behaviors including frequent fidgeting, excessive talking and appear to be "on the go." As with the inattentive presentation, to meet diagnostic criteria for ADHD-H, a minimum of 6 of the following symptoms must be

present for at least 6 months; only 5 are required for those age 17 and older (American Psychiatric Association, 2013):

1. Often fidgets with hands or feet, and/or may squirm when seated.
2. Frequently leaves their seat in a situation when it is expected to remain seated, such as in a classroom or at work place.
3. May run or climb at inappropriate times; this may appear as restlessness in adolescents and adults.
4. Difficulty in engaging in leisure activities quietly.
5. Appears as "if driven by a motor," or "on the go." This may manifest as difficulty staying still for extended periods of time, such as in a meeting, a classroom or in a restaurant.
6. Often talks excessively.
7. May blurt out the answer to a question before the question was finished.
8. Has frequent difficulty waiting their turn, such as in a line.
9. Often interrupts or intrudes on the conversations or activities of others.

Combined Presentation.

The third type of ADHD is the Combined presentation (ADHD-C). This group of individuals meet diagnostic criteria for both the Inattentive and Hyperactive/Impulsive presentations (American Psychiatric Association, 2013).

Additional diagnostic information.

For all three of the ADHD presentations, the symptoms must occur in a minimum of two settings (i.e. school and home) and cause a negative impact on an individual's social, academic and/or occupational functioning. Additionally, several of the symptoms must have been present

prior to the age of 12 and there must be clear evidence that the presence of these symptoms significantly interferes with one's social, academic or occupational functioning. DSM-5 criteria also highlight how the presence of the symptoms do not occur as a result of schizophrenia or another psychotic disorder and are not better explained by a different mental disorder such as a mood disorder, anxiety disorder or personality disorder. A diagnosis of ADHD will also specify a level of severity that results in an impairment in social or occupational functioning (American Psychiatric Association, 2013).

ADHD identification in schools.

Considering the prevalence rates in children with ADHD, the school environment is a common area in which the individual's impairment may be noticed. According to the National Center for Educational Statistics, the third most populous educational disability category is an 'Other Health Impairment' (OHI). Students with symptoms or a clinical diagnosis of Attention Deficit Hyperactivity Disorder can qualify for special education supports and related services in schools under the educational disability category of OHI, because ADHD is not considered one of the classifications within the Individuals with Disabilities Education Act (IDEA). According to IDEA regulations, OHI is defined as

> *"having limited strength, vitality, or alertness, including a heightened alertness to environmental stimuli, that results in limited alertness with respect to the educational environment, that— **(a)** is due to chronic or acute health problems such as asthma, attention deficit disorder or attention deficit hyperactivity disorder, diabetes, epilepsy, a heart condition, hemophilia, lead poisoning, leukemia, nephritis, rheumatic fever, sickle cell anemia, and Tourette syndrome; and **(b)** adversely affects a child's educational performance."*

ADHD-diagnosed students are only eligible for special education if the disability is also found to adversely affect educational performance. If a student has a diagnosis of ADHD, but it does not negatively impact their education, then that student may be eligible for a 504 Accommodation Plan. Section 504 of the Rehabilitation Act is a civil rights law that prohibits discrimination against individuals with disabilities. Section 504 ensures that the child with a disability has equal access to an education. The child may receive accommodations and modifications; however, there will not be an individualized education plan (IEP). Therefore, although 14% of students receive special education services under the disability category of 'other health impairment' this number does not include all students with a clinical diagnosis of ADHD in the schools.

Specific Learning Disability (SLD)

There are definitions of learning disabilities that date back to the 1800s (Alfonso & Flanagan, 2018). Historically, students that do not perform as expected academically were evaluated and often identified as having a learning disability (Kavale & Forness, 2006). The earliest definitions of learning disability primarily consisted of clinicians observing students who experienced significant difficulty with basic academic skills despite average or above-average general intelligence (Kaufman, 2008).

In 1963, Samuel Kirk, an American psychologist, addressed a group of professionals and parents in Chicago, Illinois at a conference entitled, 'The Exploration into the Problems of the Perceptually Handicapped Child' (Kaufman, 2008). This conference gathered information from professionals in various fields on the education of children with learning difficulties and to develop a national organization to secure resources for these children (Kaufman, 2008). Kirk defined 'learning disability' as a "retardation, disorder, or delayed development in one or more

of the processes of speech, language, reading, writing, arithmetic, or other school subjects resulting from a psychological handicap caused by a possible cerebral dysfunction and/or emotional or behavioral disturbances." He separated a learning disability from "mental retardation, sensory deprivation, or cultural and instructional factors," (Kaufman, 2008). The professionals at the conference unanimously accepted Kirk's criteria for 'Learning Disability,' and as a result the conference developed the Learning Disabilities Association of America (LDA). To this day, the LDA continues to influence legislation, diagnosis, educational practices, and research on students with learning disabilities.

Since Kirk's 1963 definition of 'Learning Disability,' definitions depict SLD as a neurologically based disorder or a disorder in psychological processing that causes learning problems and manifests as academic skill weaknesses (Alfonso & Flanagan, 2018). The term 'Specific Learning Disability' is an umbrella term for many neurological processing deficits that result in learning challenges (Alfonso & Flanagan, 2018). Individuals with SLD have specific areas of strengths and weaknesses with neurological processing that are linked to certain areas of academic skill development. Brain-imaging studies confirmed that children with SLD have unique neurological processing differences in comparison to children that are not identified with SLD (Decker, Hale, & Flanagan, 2013). Children with patterns of unique brain connectivity demonstrate with specific subtypes of SLD. Functional neuroimaging data have linked academic underachievement to specific areas of cognitive brain dysfunction (Decker et al., 2013). Identification of specific neurocognitive processing deficits may help with diagnosis; however, increasing research has identified that executive functioning deficits are correlated to all subtypes of SLD (McCloskey, 2016; Schuchardt, Maehler, & Hasselhorn 2008). There are learning

disorders in math (Dyscalculia), reading (Dyslexia), writing (Dysgraphia), oral expression, and nonverbal learning disorders (DSM-V, 2013).

There are multiple cognitive processes shared between reading and mathematics skills (Alfonso & Flanagan, 2018). The representation and retrieval of symbolic information requires attention, skills required for working memory, and cognitive control. The parietal cortex appears to be a critical processing station for both reading and mathematical domains. Additionally, the pre-frontal cortex (PFC) plays a significant role in attention and skills associated with working memory. Impairments in PFC function may underlie deficits associated with SLD in math and reading comorbidity.

There are four general subtypes of reading disorders: dysphonetic dyslexia, surface dyslexia, mixed dyslexia, and reading comprehension deficits (Feifer, 2011; Feifer & Della Toffalo, 2007). Sally Shaywitz at Yale University (2004) studies functional magnetic resonance imaging (MRIs) showing that overall dyslexic adults have under-activation of the reading area of the brain and over-activation of brain regions responsible for attention and recognition of sounds (Shaywitz & Shaywitz, 2004). Individuals with reading disabilities have atypical, less efficient, patterns of cognitive processing. Specifically, there is a failure of the left hemisphere in the rear brain systems to function properly during reading. The neural systems in frontal regions may compensate for the disruption in the posterior area (Shaywitz & Shaywitz, 2004). Diffusion tensor imaging (DTI), a form of MRI, provide evidence that the integrity of the white matter structure of the neural pathways in the left temporo- parietal region differs for good versus poor readers. Overall, if there is less gray matter in the left temporo-parietal region, individuals have more difficulty processing sounds. If there is less white matter in this region then there is less efficiency of regions of brain to communicate with one another.

Whole-brain connectivity was assessed in a sample of 75 children and 104 adult readers (Finn, et al., 2014). Compared to non-impaired readers, dyslexic readers showed divergent connectivity within the visual pathway and between visual association areas and prefrontal attention areas. There was also increased right-hemisphere connectivity, reduced connectivity in the visual word-form area, and persistent connectivity to anterior language regions around the inferior frontal gyrus (Finn, et al., 2014). Non-impaired readers are able to rapidly process visual information and modulate their attention to visual stimuli, which allows them to recognize words based on their visual properties (Finn, et al., 2014). However, dyslexic readers use alternative reading circuits and rely on difficult phonology-based "sounding out" strategies.

Individuals with SLD in math show processing deficits in a distributed, but interconnected, set of brain regions (Karagiannakis, Baccaglini-Frank, & Papadatos, 2014). Specifically, the bilateral intraparietal sulcus, which has been identified to help with representation of approximate quantities. Individuals with SLD in math also have shown deficits in regions of the prefrontal cortex (Karagiannakis, Baccaglini-Frank, & Papadatos, 2014). Individuals with these processing deficits are more likely to have challenges with more complex calculations involving visuospatial working memory and executive control functions. Overall, there are core white matter deficits in these regions that make processing quantities and calculations more difficult for these individuals.

A pattern of strengths and weaknesses in cognitive processing and executive capacity may also result in nonverbal learning disability, specific learning disability in written expression or oral language. Nonverbal Learning Disability (NLD) is a new construct that envelopes students who have difficulties in the areas of visual-spatial processing, mathematics, handwriting, social cognition, reading comprehension of abstract passages, and attention

(Pennington, 2008). Individuals with SLD may have deficits in oral language and listening comprehension; specifically, individual profiles may have strengths and weaknesses across language domains; such as, phonology, morphology, syntax, semantics, pragmatics (Alfonso & Flanagan, 2018). Writing disabilities are complex and require fine motor skill, knowledge of writing conventions, oral language, and reasoning (Berninger & Richards, 2002). Students with SLD in writing may be challenged with both poor handwriting, spelling, and written expression. Writing is a process that requires self-direction and integration of cognitive and language-based abilities.

Learning disabilities manifest in a unique manner across individuals; however, there is typically a learning profile of strengths and needs that will shift across the lifespan (National Joint Committee on Learning Disabilities, 1998). Individuals have significant difficulty with learning academic skills; such as, listening, speaking, reading, writing, reasoning, and mathematical skills despite an individual's appropriate level of effort and instruction from highly-qualified teachers. The learning disability is a manifestation of differences in central nervous system development that is present across the lifespan; however, it may be more severe throughout specific life stages. The learning disability may be co-morbid with other disabilities; specifically, self-regulation, social-emotional awareness and social interactions, sensory impairments, attention deficit hyperactivity disorders, and emotional disturbances. However, these disorders do not cause the learning disability. Finally, learning disabilities are not caused by external factors; such as, insufficient instruction, and diverse cultural or linguistic backgrounds.

Based upon widely accepted operational definitions of specific learning disabilities, federal laws and regulations have been developed to find and assist these students in schools.

The Education for All Handicapped Children Act of 1975 was enacted and the number of students identified with a specific learning disability increased by more than 300 percent (Alfonso & Flanagan, 2018). This law created formal criteria for the identification of students with disabilities and mandated all exceptional students receive a free and appropriate education (FAPE). Over the years, various classification systems for SLD were developed to determine if students were eligible for this particular diagnosis. Diagnostic criteria for SLD are included in the Diagnostic and Statistical Manual of Mental Disorders-5th edition and the International Classification of Diseases. However, the legal classification system of students age 3 to 21 years who experience learning difficulties in school are typically evaluated according to the specifications entailed in the federal regulation entitled, The Individuals with Disabilities Education Act of 2004 (IDEA).

Diagnostic criteria.

The IDEA (2004) defines a specific learning disability as "a disorder in one or more of the basic psychological processes involved in understanding or using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations" (IDEA, 2004). As of 2015, all 50 states have adopted the federal definition of SLD (Alfonso & Flanagan, 2018). As early as 1976, the U.S. Office of Education specified that "a specific learning disability may be found if a child has a severe discrepancy between achievement and intellectual ability," (Cottrell & Barrett, 2015).

The DSM-V defines SLD as a neurodevelopmental disorder that can have varying degrees of severity. The SLD diagnosis can be mild, moderate, or severe. It is recommended that each impaired academic domain and subskill should be recorded. Essential diagnostic features of SLD are persistent difficulties with keystone academic skills with onset during years of formal

school. Difficulties mastering these key academic skills may also impede learning in other academic subjects. Associated features consist of: delays in attention, language, and motor skills. It is defined by the following diagnostic criteria:

A. Difficulties learning and using academic skills, as indicated by the presence of at least one of the following symptoms that have persisted for at least 6 months, despite the provision of interventions that target those difficulties:
    1. Inaccurate or slow and effortful word reading.
    2. Difficulty understanding the meaning of what is read.
    3. Difficulties with spelling.
    4. Difficulties with written expression.
    5. Difficulties mastering number sense, number facts, or calculation.
    6. Difficulties with mathematical reasoning.
B. The affected academic skills are substantially and quantifiability below those expected for the individual's chronological age, and cause significant interference with academic or occupational performance, or with activities of daily living, as confirmed by individually administered standardized achievement measures and comprehensive clinical assessment. For individuals 17 years and older, a documented history of impairing learning difficulties may be substituted for the standardized assessment.
C. The learning difficulties begin during school-age years but may not become fully manifest until the demands for those affected academic skills exceed the individual's limited capacities.

D. The learning difficulties are not better accounted for by intellectual disabilities, uncorrected visual or auditory acuity, other mental or neurological disorders, psychosocial adversity, lack of proficiency in the language of academic instruction, or inadequate educational instruction.

Prevalence.

The prevalence of specific learning disorder across the academic domains of reading, writing, and mathematics is 5-15% among school age children (DSM-V, 2013). Reading disorder (dyslexia) is the most common form of SLD. An estimated 70 to 80 percent of those with a learning disorder have a reading disorder (Alfonso & Flanagan, 2018). Students can demonstrate need in more than one SLD subtype. For instance, two-thirds of children with a math learning disability also have a reading disability (Ashkenazi, Black, Abrams, Hoeft, & Menon, 2013). However, the identification methods of SLD in schools can be vague and vary amongst various districts and states.

SLD identification in schools.

The reauthorization of the IDEA in 2004 continued to permit the discrepancy criterion; however, the federal regulation also permitted states the "use of a process based on a child's response to scientific, research-based interventions and may allow the use of other alternative research-based procedures for determining children with SLD," (IDEA, 2004). However, the IDEA does not define specific measures to identify SLD. Therefore, state and local education agencies may choose to identify students with SLD through use of the ability-achievement discrepancy model, response-to-intervention (RTII), or alternative research-based methods; such as, the evaluation of a student's pattern of strengths and weaknesses (Cottrell & Barrett, 2015). The federal regulations also allow state education agencies (SEAs) and local education agencies (LEAs) to choose the method and tools for SLD identification based upon local norms.

Consequently, there are inconsistent methods of SLD identification throughout the United States (Cottrell & Barrett, 2015).

According to best practices, the evaluation process to identify SLD is completed by a multidisciplinary team of qualified, school-based professionals (National Joint Committee on Learning Disabilities, 1998). The process determines if a student's learning problems are due to a learning disability or some other explanation. The team collaborates to identify the student's academic strengths and weaknesses using formal and informal assessments. A student's problem area is compared with other students within the same age group. The assessments strive to determine if the student's low academic performance is due to cognitive processing differences or poor instructional history, cognitive abilities, or diverse cultural and linguistic background. The comprehensive evaluation should include a variety of data sources and assessments. A record review is required to determine the student's history and developmental background. Observations of the student in the learning environment and interviews with the student, teacher, and parent or legal guardian assist with diagnostic differentiation. It is crucial that the team utilizes procedures that are culturally competent and sensitive to the student's language of origin and socio-economic background.

The interpretation of diagnostic criteria and identification of SLD is typically completed by a school psychologist. It is usually the role of the school psychologist to lead the evaluation process and employ standardized tests that are reliable, valid, and have current age-appropriate normative data. Cottrell and Barrett (2015), surveyed 471 school psychologists about their school SLD identification guidelines and assessment methods used (i.e., ability-achievement discrepancy, response-to-intervention, and the evaluation of students' pattern of strengths and weaknesses). If the school-based team requested an evaluation for a student, the majority of

school psychologists surveyed reported that they used the SLD identification method that guaranteed the students received special education services (Cottrell & Barrett, 2015). The majority of school psychologists reported that the ability-achievement model continues to be a widely used tool for SLD identification (Cottrell & Barrett, 2015). Also, response-to-intervention (RTII) appeared to be allowed in most school psychologists' schools; however, there was inconsistency in its implementation or operationalization. According to Cottrell & Barrett (2015), support for alternative research-based procedures such as pattern of strengths and weaknesses (PSW) is minimal. The majority of responses reported that school guidelines never allowed this method. Therefore, PSW is not a method of SLD identification that is typically being used and has similar implementation and conceptualization issues as the other methods used for SLD identification.

Most school psychologists reported they are unclear about their school SLD identification guidelines (Cottrell & Barrett, 2015). For both ability-achievement and PSW methods, most school psychologists were unclear how their school defined a discrepancy (e.g., 1 standard deviation vs. 1.5 standard deviations) between a student's ability and achievement scores or factor/index scores within a single assessment. School guidelines were more likely to define the method of SLD identification and were less likely to define aspects that guide actual implementation of the different methods. Many school psychologists work in schools with unclear guidelines when identifying students with SLD. This is a major problem that contributes to students' being misidentified, over-identified, and an overall lack of reliability in the identification of students with SLD in the United States (Cottrell & Barrett, 2015).

Ability-achievement discrepancy for SLD identification. The discrepancy model requires that a statistical difference between a student's intellectual ability and academic

achievement must be identified for the student to meet federal regulation guidelines for SLD (Alfonso & Flanagan, 2018). It is utilized for identification of SLD because it assists in operationally defining 'unexpected underachievement' (Alfonso & Flanagan, 2018). Since 1977, the discrepancy model as outlined by the federal regulations is the main assessment method to identify students with SLD (Kaval & Flanagan, 2007). Ability is typically measured through a standardized IQ assessment and achievement is measured through a standardized academic achievement assessment (Taylor et al., 2017). The discrepancy model employed in most states requires that the following four criteria are met before determining eligibility for SLD: (a) discrepancy between cognitive ability and academic achievement, (b) identifying a psychological processing deficit, (c) determining if the child's educational needs can or cannot be met without special education and related services, and (d) exclusionary considerations (Alfonso & Flanagan, 2018).

In recent years, many failures have been identified with the ability-achievement discrepancy model (Alfonso & Flanagan, 2018). This model has become one of the more controversial out of the three methods to determine SLD (Ihori & Olvera, 2014). The model tends to over-identify students with SLD, especially students from minority groups (Taylor et al., 2017). The model also does not adequality differentiate a student with a learning disability from students who are low achievers (Alfonso & Flanagan, 2018).

The model relies on the assumption that an IQ assessment is a valid predictor of achievement (Pietschnig, 2016). The IQ test was originated in 1905 by Alfred Binet and Theodore Simon to identify French students with cognitive impairments (Kanaya, 2016). Ten years later, Lewis Terman created standardized age-appropriate norms and translated the test into English to identify mentally gifted children (Kanaya, 2016). The purpose of the tests was to

compare individuals within a specific context at the same time with a specific purpose (Kanaya, 2016). The Flynn effect determined that IQ in the general population increases about 3 IQ points per decade (Pietschnig, 2016). IQ test manufacturers update norms every 10 to 15 years to address the increase; however, the Flynn effect raises the question that the observed gains may indicate flawed test instruments or flawed intelligence definitions (Pietschnig, 2016).

Additionally, studies have shown mean differences in IQ scores across various ethnic groups. Researchers have argued that these differences are reflective of test bias against multicultural differences (Esters, Ittenbach, &Han, 1997). There are many arguments about how it is inappropriate to use IQ tests to make decisions about a student's cognitive abilities in a culturally diverse group of children. For instance, the test items may be culturally inappropriate, normative populations are not always culturally competent; there may be language differences between the examiner and examinee; and there may be differences in educational standards and programming (Ester et al., 1997). In addition to ethnicity, socioeconomic status (SES) also has a significant impact on IQ test results. The use of the ability-achievement discrepancy model, which relies on IQ testing, may be unethical when making educational programming and disability category decisions for students from diverse ethnicities and social classes.

Alternative research based procedures for SLD identification. The criteria for a specific learning disability as defined by the 2004 reauthorization of the Individuals with Disabilities Education Improvement Act includes "the use of other alternative research-based procedures for determining children with SLD" (IDEA, 2004). The third option involves the evaluation of a pattern of strengths and weaknesses (PSW) through a combination of cognitive tests, academic achievement assessments, and neuropsychological and executive functioning assessments

(Alfonso & Flanagan, 2018). The educational community has recently become more interested in the patterns of strengths and weaknesses model (Ihori & Olvera, 2014).

The PSW model requires evidence of a specific weakness in a basic psychological process that corresponds to a specific weakness in achievement test scores (Alfonso & Flanagan, 2018). A basic psychological process refers to a foundational neurocognitive ability that allows an individual to function in multiple settings (Naglieri & Das, 2005). The PASS theory summarizes psychological processing functions that underlie mental and physical activities. PASS is an abbreviation for; planning, attention, simultaneous processing, and successive processing (Naglieri & Das, 2005). The PASS processes represent both cognitive and neuropsychological constructs; i.e., executive functioning (Alfonso & Flanagan, 2018). SLD may be considered if the evaluation indicates a discrepancy amongst psychological processing scores; a discrepancy amongst achievement scores; or consistency between a low processing score and low achievement scores (Alfonso & Flanagan, 2018).

According to CHC Theory, the broad areas of psychological processing consist of; comprehension-knowledge, fluid reasoning, quantitative knowledge; reading and writing ability; short-term memory; long-term storage and retrieval, visual processing, auditory processing, and processing speed. The examiner needs to document the way the cognitive weakness or deficit manifests in his or her academic performance. The overarching difference between the ability-achievement discrepancy model and the PSW model is that the discrepancy model uses a total test score from an intelligence test to determine SLD identification (Flanagan & Schneider, 2016).

Response to intervention for SLD identification. In the reauthorization of the IDEA in 2004, the federal law allocated that an LEA can, “use a process that determines if the child

responds to scientific, research-based intervention as a part of the evaluation procedures," (IDEA, 2004). The change in the law introduced the concept of Response to Intervention (RTI) to identify individuals with SLD. RTI uses assessment data to provide resources in an efficient manner based upon student need (VanDerHeyden & Burns, 2010). Student need is determined by conducting universal screening in reading and math skills. Universal screening is a quick assessment that can monitor student progress. Curriculum-based measurements (CBMs) are quick assessments that are often used for universal screening. There are CBMs for early literacy, reading, mathematics, and writing that are provided by several CBM platforms; such as, Aimsweb, DIBELs, and easyCBM (Alfonso & Flanagan, 2018).

Educational programming decisions are made based upon comparing a school's individual and universal screening data to national or local norms (Fuchs, 2003). The school's educational programming is formed with varying tiers of support that are allocated based on student need. Tier 1 is the core instructional program and tier 2 can consist of a small-group intervention program that is matched to student need (Fuchs, 2003). It is estimated that approximately 5% to 10% of students may need additional supports; such as, small group instruction and individualized interventions with support of a multidisciplinary school-based team (Alfonso & Flanagan, 2018). This group is considered Tier 3 and these students require the most supports and monitoring of progress.

Decision rules help develop the criteria warranted for allocating the various levels of intervention. The decision rules identify students who are not making progress in response to interventions. These students are typically moved to increasingly intensive tiers of intervention (Alfonso & Flanagan, 2018). The decision rules can also identify universal needs. If all students are demonstrating weakness with specific skills assessed by curriculum-based assessments, then

there may be a need for a class-wide intervention or change in curriculum. Curriculum-based measurements strive to make individual and school-wide interventions more effective because the data can target specific areas of need.

Progress monitoring data is best interpreted by analyzing the student's performance level and rate of growth (Fuchs, 2003). If a student continues to make insufficient progress at Tier 3, then the student can potentially be identified with SLD. However, the federal law does not describe how RTI should be implemented or used to identify students with SLD (Maki, Floyd, & Roberson, 2015). Therefore, states create frameworks to identify students with SLD using RTI. Some states require a minimum number of progress monitoring data points, specific number of interventions attempted, student achievement below a specific percentile rank, or data regarding intervention fidelity (Maki et al., 2015). The variability in each state's use of RTI for SLD identification has caused increased variability in the prevalence rates of SLD from state to state. It is unclear if the RTI model authentically identifies SLD; however, no SLD identification model has been well-validated (Fletcher et al., 2011).

The response to intervention model does not fulfill the current definition of SLD (Alfonso & Flanagan, 2018). RTI can identify students that are underachieving in comparison to the norm group, but it does not assess individual cognitive abilities, which determines if a student's level of achievement is expected or under-expected (Alfonso & Flanagan, 2018). The RTI approach can identify students in need of intervention earlier than the ability-achievement discrepancy model, because it relies on quick and timely progress monitoring data. Students start to receive interventions as soon as a need is demonstrated; and furthermore, the data is directly linked to interventions. In comparison, the ability-achievement and PSW models have been criticized for not directly linking assessment data to intervention (Vaughn & Fuchs, 2006).

Cognitive processes can be trained; however, the training has not been found to improve student achievement (Kearns & Fuchs, 2013). The RTI model used many pieces of data over time in comparison to the PSW and ability-achievement model which base high-states decisions on data collected at one period (Alfonso & Flanagan, 2018). However, RTI requires school-wide prevention and reform to implement the model with integrity, which is difficult due to the ease of implementing an IQ and achievement test to identify students with SLD.

Executive Functions

The concept of executive functions (EF) refers to the ability to cue our brains neural networks to initiate functions related to higher order processes including reasoning, problem solving, organization, planning, working memory, behavior regulation, and self-monitoring as well as the ability to focus and sustain attention (Williams &Thayer, 2009). The basis for the concept of executive functions was initiated by scientists that wanted to understand the prefrontal cortex (PFC) (Luria, 1966). There have been various operational definitions of EF that have been debated amongst professionals in the fields of neurology and neuropsychology for decades.

EF was originally theorized to be largely localized to regions of the frontal lobes, specifically the PFC. Executive functions were described as the "Chief Executive Officer (CEO)" or "Central Executive" of the brain located in the frontal lobe of the brain (Goldman-Rakic, 2001). Executive functions have been identified to occur in the prefrontal cortices. Specifically, the dorsolateral prefrontal cortex (DLPFC) is involved with integrating different dimensions of cognition and behavior. Neural networks attributed to executive functioning are also interconnected with other portions of the brain. This can include portions of the limbic system, (emotional processing), reticular activating (arousal) system, posterior association cortex (perceptual and cognitive processes) and motor regions of the cerebellum (Groenewegen, Wright

& Uylings, 1997; Thiebaut de Schotten, Dell'Acqua, Valabregue & Catani, 2012; Tyson, Lantrip & Roth, 2014).

Therefore, the analogy of EF to a 'CEO' is no longer an effective analogy as neurologists have not identified a specific frontal homunculus or unitary executive function region in the brain (Stuss and Alexander, 2000). McCloskey (2016) identified a more valid metaphor for EFs as the "supervisory system" that is comprised of managers and workers. In this metaphor, the executive control system is described as the first line managers, who are responsible for connecting information to other parts of the brain. Then there are the workers, who are responsible for sending and receiving communications necessary to effectively direct perceptions, feelings, thoughts and behaviors.

McCloskey, Perkins, & Divner (2009) proposes that executive functions are a set of self-directed and coordinated capacities that cue the use of other cognitive domains; such as, reasoning, language, and visuospatial representation. Executive functions facilitate a person's ability to engage in purposeful processing of perceptions, emotions, thoughts, and actions. McCloskey's model for executive functions synthesizes various writings on executive functions into a single overarching theory of executive control.

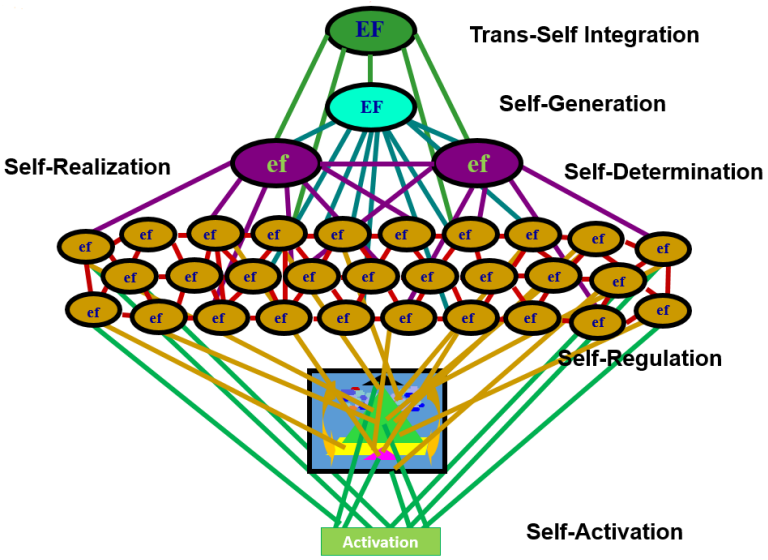
Holarchical model of EF.

The Holarchical Model of EF (HMEF) (*Figure 1)* proposed by McCloskey (McCloskey, Perkins, & Diviner, 2009; McCloskey& Perkins, 2012; McCloskey, 2016) views EFs as an overarching neuropsychological construct. The model is proposed as a way to organize and conceptualize the interplay of various EFs involving the use of portions of neural networks routed throughout the frontal lobe. Within the Holarchical model are multiple tiers of executive control that have separate control functions. The tiers include the Self-Regulation, Self-

Realization and Self-Determination, Self-Generation, and Trans-self Integration and the capacity for Self-Activation (an aroused state of consciousness) that always precedes engagement of executive control (see Figure 1). The HMEF was used as the theoretical model in the creation of the McCloskey Executive Functions Scale (MEFS)-School Age Teacher Form.

McCloskey (2016) proposes the use of the term Executive Capacities (EC) as an overarching category that encompasses both Executive Functions and Executive Skills. The delineation between these two concepts is needed to distinguish between the ability to cue awareness of the need to perceive, feel, think or act in a specific manner – the executive function, versus the ability to activate the other parts of the brain needed to perceive, feel, think or act consistent with the awareness – the executive skill.

Figure 1. Tiers of Executive Control – Holarchical Model of Executive Capacities



Self-regulation tier.

The Self-Regulation tier identifies 31 different self-regulation executive capacities that are responsible for the cueing, directing, coordinating and integrating of daily functioning across the domains of perception, emotion, cognition and action. The 31 self-regulation executive

capacities are grouped into 7 clusters. The clusters are: Attention, Engagement, Optimization, Efficiency, Memory, Inquiry and Solution.

Attention.

The Attention cluster includes the Perceive, Focus and Sustain capacities. Perceive refers to the cueing of sensory and perceptual processes to take in information within the environment. This is evaluated by inquiring about a student's ability to know what to do for academic tasks, and examining their ability to make eye contact, listen or touch others in an appropriate way during social interactions. Focus cues the direction of attention to important information in the environment; this is examined regarding school tasks and social situations. Sustain refers to the ability to maintain one's attention during academic tasks or social situations.

Engagement.

Within the Engagement cluster are the Initiate, Energize, Inhibit, Stop, Pause, Flexible and Shift ECs. Initiate refers to the cueing needed to initially engage a task, such as starting school work or engaging peers in appropriate social interactions. Energize refers to cueing an adequate investment of energy to complete school work or social interaction. Questions on the MEFS which evaluate Inhibit ECs examined one's ability to suppress impulsive urges in academic or social contexts. This can include waiting for a turn, considering consequences, refraining from physical or verbal aggression, and maintaining emotional control during school work or social situations. Stop refers to the immediate cessation of various behaviors, such as talking about a single topic, engaging in preferred activities or doing things that may annoy others. Pause examines a student's ability to return to a school task following a brief interruption or pausing to allow a someone else make a comment during a conversation. Flexible refers to one's ability to alter perceptions, feelings, thoughts, or actions based on internal or

environmental stimuli. This is examined by engaging alternative methods when one is stuck during an academic task, accepting changes in school work or routines, or accepting changes with a familiar or unfamiliar person. The Shift EC examines one's ability to move between school tasks or between activities in a social situation.

Optimization.

Optimization includes the following EFs: Monitor, Modulate, Correct and Balance. The Monitor EF refers to the cueing needed to evaluate the accuracy of perceptions, feelings, thoughts or actions. This is examined by a student checking school work for mistakes, having necessary school materials prior to leaving class or school, recognizing if behavior negatively affects others or being aware of one's appearance and hygiene. Modulate cues adjusting the intensity of the appropriate level of physical activity needed for school tasks or within a group and the level of emotional response during school tasks or social interaction. Modulate also examines if the student is able to avoid becoming overstimulated or understimulated by various sensory or environmental stimuli. Correct cues the use of appropriate routines for correcting errors on school work or apologizing after offending others. Balance cues the regulation of the trade-off between opposing processes or states. This is examined by the student's ability to balance elements of a school assignment (i.e. quality vs quantity) or maintaining a balance in social situations (i.e. talking vs listening).

Efficiency.

Within the Efficiency cluster is Sense Time, Pace, Use Routines and Sequence. Sense Time cues the awareness of the passage of time when completing school tasks and/or when talking or interacting with others. Pace cues the regulation of the rate at which perceptions, emotions, cognitions are experienced, or actions are performed. This is examined by inquiring if

the student changes pace when taking tests or completing school assignments, or when communicating in a conversation. Use Routines cues the engagement of a well-known series of perceptions, feelings, thoughts, and/or actions, especially in cases where automated routines have been practiced and used frequently. This is examined by the students use of well-rehearsed routines for school tasks or social greetings, using strategies to complete school work, participating in conversations on familiar topics and ensuring they have all materials needed for homework and assignments. Sequence cues the orchestration of the proper steps needed to complete a school task in the correct order, or by retelling a series of events when telling a story.

Memory.

The Memory cluster includes the Hold/Manipulate and Store/Retrieve EFs. Hold/Manipulate cues the initial registration and holding of information in mind to make it available for mental manipulation. Evaluation of these skills is completed by examining a student's ability to keep information in mind for short periods of time during school tasks or when talking with others. Store/Retrieve cues awareness of the need to store newly learned information or to retrieve previously stored information. This skill is assessed by a student's ability to recall information on a school subject, particularly when taking a test, and being able to recall information about social situations and information on themselves and others.

Inquiry.

The EFs within the Inquiry cluster are the Gauge, Anticipate, Estimate Time, Analyze and Evaluate/Compare EFs. Gauge cues the awareness needed to accurately estimate the difficulty of a school task or test, or to figure out how to appropriately interact in social situations. Anticipate cues the anticipation of events at school, such as an assignment, and/or how what a student says or does affects other's thoughts and feelings, and the consequences of

their own thoughts or actions. Estimate Time cues the assessment of the time needed to complete a school task, or how long it will take to do something when speaking or interacting with others. Analyze examines and analyses both school tasks and comments or actions made in social settings, in more detail. Evaluate cues the examination of the quality and/or adequacy needed to complete school tasks or engage in social interactions.

Solution.

The Solution cluster includes the Generate, Associate, Organize, Plan, Prioritize and Decide EFs. Generate cues an awareness of the need for novel problem-solving, such as determining a new way to complete a school task or generating new ideas about what to say to or do with others. The Associate EF cues an awareness of the need to make connections among previous experiences to find solutions to a problem. Within the academic context, students utilize this ability to understand how multiples things or ideas are similar and can be used to solve a problem with school or work. Regarding Associate's application to the social context, the student's ability to see a similarity with a previous social situation can be used to solve a social relationship problem. Organize cues the awareness of the need to organize school tasks or age appropriate social activities. Plan cues an awareness of the abilities needed to plan for school tasks, for age appropriate social activities or for use of their own time. Prioritize cues an awareness of the need to order or select activities based on their level of importance. This is evaluated by how the student orders school tasks or how they handle social situations, based on their relevance, importance or urgency. Decide examines how a student will make their own decisions about what/when school tasks need to be completes, and what/when social interactions are deemed appropriate.

Self-realization and self determination.

Within the second tier of the HMEF are the Self-Realization and Self-Determination subdomains. These EFs examine abilities that extend beyond the capacities described in the Self-Regulation tier. Rather than directly supervising perceptions, feelings, thoughts, or actions, the roles of the Self-Realization and Self-Determination subdomains exist to manage other Self-Regulation managers.

Self-realization.

The Self-Realization subdomain examines various abilities with regard to self-regulation of thoughts and behaviors. Within the Self-Realization subdomain, an individual is evaluated in their Awareness of Themselves, Awareness of Others and Analysis of Self and Others. To demonstrate Awareness of Themselves, students are evaluated in their ability to make realistic comments about their own mental and emotional strengths and weaknesses, these physical abilities of how they feel or think about themselves. With regard to Awareness of Others, students are evaluated in their ability to make realistic comments about the mental and emotional strengths and weaknesses, or physical abilities of others. Additionally, students are evaluated to determine their ability to make realistic comments about how others may view others, how others view the student, or how others view themselves. Regarding Analysis of Self and Others, students are evaluated about their ability to realistically analyze and comment about their school performance, to know how others view them or their ability to manage themselves.

Self determination.

Within the Self Determination subdomain, the student's abilities are assessed regarding Goal Setting and Long-Term Planning. Goal-Setting is assessed by their ability to state realistic goals for schooling and work beyond schooling, based on personal interests. Additionally, the

student is assessed based on their frequency of expressing strong desires to make their own decisions about what to do, rather than based on what parents or others say. Long-Term Planning refers to their ability to make realistic plans for accomplishing long-term goals related to work, school and personal/social interests.

Arenas of involvement.

The HMEF also posits the concept of Arenas of Involvement. This concept helps to explain the range of variability in engagement of self-regulation capacities in different contexts that is often observed or reported in clinical cases. The HMEF identifies four Arenas of Involvement: the Intrapersonal Arena, the Interpersonal Arena, the Environment Arena and the Symbol System Arena.

Intrapersonal Arena.

The Intrapersonal Arena refers to the use of self-regulation executive capacities to direct perceptions, feelings, thoughts and actions in relation to oneself, often referred to as self-discipline or self-management. Effective use of self-regulation executive capacities within this arena enables a person to avoid, or effect changes in self-destructive perceptions, feelings, thoughts or actions that are associated with conditions such as depression, anxiety, addictions, self-mutilation and eating disorders.

Interpersonal Arena.

The Interpersonal Arena refers to the self-regulation of perceptions, feelings, thoughts and actions when engaged with other people. Effective use of self-regulation executive capacities within this arena enables a person to relate to others in an appropriate manner, work cooperatively with others and resolve interpersonal conflicts or solve social problems.

Environment Arena.

The Environment Arena refers to one's use of self-regulation capacities to cue and direct perceptions, feelings, thoughts and actions in relation to both natural and man-made environments. Effective use of executive capacities in this arena enable a person to function effectively when performing everyday tasks, maintain tools and other implements needed to perform these everyday tasks, avoid accidents, and perceive, feel, think and act in ways that support and sustain the natural environment.

Symbol System Arena.

The Symbol System Arena refers to one's use of self-regulation executive capacities to cue and direct perceptions, feelings, thoughts and actions relating to the processing, storage, and use of information transmitted through symbol systems. Successful use in this area can assist in the ability to regulate academic tasks, including reading, writing, speaking or quantifying, assist with work in the science or mathematical fields, enhance formal systems of thought and knowledge and enhance the use of communication tools, including computers.

Executive Functions and Neuropsychological Assessments

There are various limitations to assessment of executive functioning. The definition is not well-developed and agreed upon; therefore, it is a difficult task to assess a vague concept. EF measures demonstrate some difficulty regarding their ecological validity or applicability to real life scenarios and behavior (Anderson, 2002). As a sense of novelty is important to appropriately assess EF, the structured nature of standardized assessments can inhibit the ability to measure an individual's use of EFs. Often, these neuropsychological assessments are administered in quiet, structured settings where distractions are controlled for, a situation likely not representative of the individual's home, social or classroom environment. These one-to-one

scenarios are rarely encountered in everyday life situations and may produce an increase in attention and motivation to task. Due to the limitations of one-to-one assessment procedures, assessment of EF in children should be conducted utilizing a variety of methods, including behavior rating scales, direct assessments, and observations and/or interviews with relevant parties, including parents and school staff (McCloskey et al., 2009; McCloskey & Perkins, 2012).

Direct assessments.

Various neuropsychological assessment tools can be utilized to assess EFs. Assessments such as the Delis-Kaplan Executive Functioning System (D-KEFS) and the NEPSY-II provide the opportunity to assess various components of an individual's EFs. The use of these tests can provide some insight into an individual's use of ECs to cue and direct task performance within the Symbol system Arena of Involvement.

Delis-Kaplan Executive Function System.

The Delis-Kaplan Executive Function System (D-KEFS) is an individually administered assessment that provided a comprehensive evaluation of higher-level cognitive functions in children and adults (Delis, Kaplan & Kramer, 2001). This assessment is often utilized by psychologists and clinicians to assess and diagnose a child's strengths in the areas of planning, impulsivity/inhibition, abstract thinking and problem solving. In addition, the D-KEFS can be utilized with individuals suspected of having ADHD or a traumatic brain injury (Delis et al., 2001). The D-KEFS' is comprised of 9 subtests that evaluate different EF abilities by having the participant complete subtests that require them to successfully problem solve verbal and spatial information, plan actions and utilize deductive reasoning (Vasilopoulos et al., 2012).

NEPSY-II.

The NEPSY-II is another individually administered assessment battery, which provides a comprehensive assessment of a wide variety of areas of potential neuropsychological deficit. Various areas assessed by the NEPSY-II, include attention, EF, language, memory and learning, sensorimotor functioning, visuospatial processing and social perception (Korkman, Kirk & Kemp, 2007). In specific, certain subtests within the EF domain require the participants to sequence and sort certain objects and pictures or vocalize verbal statements by the evaluator (Korkman et al., 2007).

Rating scales.

In addition to the direct assessments, various rating scales are available that can be beneficial in examining EF. A multidisciplinary assessment conducted within an educational setting often includes input from relevant parties, including parents, teacher and the students themselves. One method to gain objective information is to provide rating scales to individuals familiar with student as well as to the students themselves when they are old enough to use self-report measures.

These scales utilize objective rating systems to gain input from various parties including the parents, school staff or examinees themselves. Various EF rating scales include but are not limited to the Behavior Rating Inventory of Executive Function-Second Edition (BRIEF-2, Gioia, Isquith, Guy, & Kenworthy, 2015), Delis-Rating of Executive Functions (D-REFS, Delis, 2012), the Comprehensive Executive Function Inventory (Goldstein & Naglieri, 2012) and the McCloskey Executive Functions Scale (MEFS; McCloskey, 2016).

Behavior Rating Inventory of Executive Function-Second Edition.

A commonly used rating scale to assess EF is the Behavior Rating Inventory of Executive Function- Second Edition (BRIEF-2). The BRIEF-2 can be used to evaluate children and adolescents with developmental and acquired neurological conditions, such as learning disabilities, ADHD, traumatic brain injuries, low birth weight, Tourette's Disorder and SLD (Gioia et al.,2015). The responses obtained by the participants are grouped into various subscales that are labeled as Inhibit, Self-Monitor, Shift, Emotional Control, Initiate, Task Completion, Working Memory, Plan/Organize, Task-Monitor and Organization Of Materials.

As previously stated, deficits in the areas of EF cannot be used exclusively to determination a diagnostic category or classification, however the information obtained during EF assessments can provide information that can be used as part of the diagnostic process and can be used to help identify appropriate interventions. A true diagnosis depends on a comprehensive assessment including history, observations and testing (Gioia et al., 2015; McCloskey & Perkins, 2012).

Delis-Rating of Executive Function.

The Delis-Rating Of Executive Function (D-REF) is a measure of an individual's behaviors related to EF difficulties created by Dean C. Delis, in 2012 (Delis, 2012). The D-REF offers a 36 item rating scale in teacher, parent and self-report forms to examine EF in children and adolescents ages 5-18. The D-REF can be utilized by school psychologists and clinicians in the process of evaluating various disorders including but not limited to ADHD, autism, traumatic brain injury, neurological/psychiatric disorders and learning disabilities (Delis, 2012). The D-REF can be utilized to examine and track changes in behavior following intervention. Results of the D-REF yield a total composite score generated from the following three core indexes:

behavioral functioning, emotional functioning and cognitive functioning. In addition, there are four additional second level index scores that identify patterns of clinically relevant symptoms: attention/working memory index, activity level/impulse control index, abstract thinking/problem solving index and compliance/anger management index (Delis, 2012).

Comprehensive Executive Function Inventory.

The Comprehensive Executive Function Inventory (CEFI) is a comprehensive behavior rating scale created by Jack Naglieri and Sam Goldstein (2012). The CEFI examines EF strengths and weaknesses in children aged 5 to 18. The CEFI is a 100-item survey available in parent, teacher and self-report forms. Results from a CEFI examine various areas of EF including Attention, Inhibitory Control, Planning, Emotion Regulation, Initiation, Self-Monitoring, Flexibility, Organization and Working Memory. These subscales combine to create an EF Full Scale. The normative sample of the CEFI included over 1,400 children some of whom had confirmed diagnoses from the DSM-IV-TR or were receiving special education services at the time of data collection (Naglieri & Goldstein, 2012).

McCloskey Executive Functions Scale.

The McCloskey Executive Functions Scale (MEFS) is an internet-based rating scale developed to examine teachers', parents' and students' perceptions regarding a students' use of executive functions and executive skills (McCloskey, 2016). To date, only the Parent Form of the MEFS has been standardized. Based on a national norm sample of over 1,000 children, ages 5-18, the MEFS Parent form assesses most of the executive capacities identified in the Holarchical Model of Executive Functions (HMEF; McCloskey, 2016).

According to McCloskey (2016), the MEFS was designed as an alternative to previously created rating scales which would often focus on a narrow group of EFs. The MEFS was

designed to highlight not only EC deficits but also to examine various EF strengths. Based upon the previously described Holarchical model, the MEFS examines the executive control constructs of Self-Realization, Self-Determination and Self-Regulation (McCloskey, 2016). The use of this model allows for a broader and comprehensive examination of EF strengths and needs.

The MEFS is comprised of 104 questions that examine the 31 ECs described in the Self-Regulation tier of the HMEF, in addition to the Self-Realization and Self-Determination tiers. The four previously indicated arenas of involvement have been reduced into only two. The Symbol System and Environment arena were both combined to form the Academic arena, and the Intrapersonal and Interpersonal arenas were combined into the Self/Social arena. The items within the MEFS are assessed by teachers utilizing a rating system of 0-5 as indicated in Figure 2. The use of this unique rating scale allows for more variability within one's response and therefore reduces the potential for dichotomous thinking in a response. Additionally, the use of the word "prompting" and related terms allow for further differentiation between a functional deficit or a skill deficit.

Figure 2. MEFS Rating Scale Responses

5	AA	Always or almost always does this on his or her own. Does not need to be prompted or reminded (cued) to do it.
4	F	Frequently does this on own without prompting
3	S	Seldom does this on own without being prompted, reminded, or cued to do so.
2	AP	Does this only after being prompted, reminded, or cued to do it.
1	DA	Only does it with direct assistance. Requires much more than a simple prompt or cue to be able to get it done in situations that require it.
0	UA	Unable to do this, even when direct assistance is provided.

EF Impairment and Implications

ADHD and EF.

Executive skills difficulties are considered a crucial component of understanding ADHD (Barkley, 2015). ADHD is diagnosed due to symptoms of persistent, developmentally atypical and impairing symptoms of inattention, hyperactivity and impulsivity. There are cognitive features of ADHD that present as deficits in executive functions (Barkley, 1997).

Barkey (1997) stated that behavioral inhibition is the primary deficit in ADHD, specifically for the subtypes with hyperactivity (i.e., the predominantly hyperactive-impulsive type and the combined type). The behavioral inhibition leads to secondary impairments in working memory and self-regulation. Barkely (1997) observed behavior of ADHD children with hyperactivity, such as excessive and impulsive responding in interpersonal communication, as evidence for these children's inability to delay responding.

Neuropsychological studies provide further evidence that there are deficits in performance by children with ADHD on tests that assess executive functions (Barkley, 2015). The Behavior Rating Inventory of Executive Functioning (BRIEF) is a parent and teacher report measure designed to assess executive skills in everyday life. There are various studies that aim to address specific areas of executive dysfunction for children with ADHD-Inattentive and ADHD-Combined Type as measured by the BRIEF (Gioia, Isquith, Guy & Kenworthy, 2000; McCandless & O'Laughlin, 2007; Diamond, 2005).

Gioia et al., (2000) analyzed BRIEF profiles and identified similarities in those participants diagnosed with ADHD, in that the ADHD group had a significantly higher degree of EF deficits as compared to their nonclinical peers. More specifically, differences were noted between the inattentive and combined subtype groups. The participants with ADHD

demonstrated more concerns on the Shift, Working Memory, Plan/Organize, Organization of Materials, and Task Completion subscales (Gioia et al., 2000). Although children with ADHD-Inattentive Type demonstrated higher scores on the Inhibit and Emotional Control scales, those within the ADHD-Combined type group scored significantly higher on the Inhibit, Emotional Control, and Monitor scales. Overall, children with ADHD-Combined Type have been found to have more problems inhibiting impulsive actions; whereas, children with ADHD-Inattentive Type are less able to organize and execute planned activities (McCandless & O'Laughlin, 2007; Diamond, 2005).

During the standardization of the MEFS, ratings were obtained for a group of children diagnosed with ADHD and were compared to a matched control sample of nonclinical peers. Additionally, comparisons were evaluated between medicated and nonmedicated ADHD groups. The authors hypothesized that EF deficits would vary between these two groups. Results indicated that across all seven Clusters within both the Academic and Self/Social arenas of involvement, the ADHD medicated group consistently displayed fewer EF deficits than the ADHD nonmedicated group. One exception was noted for the Optimization cluster within the Self/Social Arena. For both ADHD groups, percentages for the Attention and Memory clusters were much higher within the Academic Arena as compared to the Self/Social Arena. As predicted by the authors of the MEFS, the ADHD nonmedicated group exhibited greater attention difficulties in the Academic Arena in comparison to the Self/Social Arena. This group also demonstrated a significantly lower score on the Self-Determination Cluster when compared with the matched control group. Results from the MEFS standardization clinical samples suggest that those with ADHD may demonstrate greater difficulty with EC when engaged with

school work than when managing themselves or themselves in relation to others (McCloskey, 2016).

SLD and EF

Learning disorders are present when individuals' abilities in the domains of reading, spelling, or arithmetic are substantially below their expected potential given their age, general intelligence, and education (DSM-V, 2013). There is increasing research that strives to examine SLD and underlying executive function deficits. Children with specific reading and/or math disabilities have difficulties with the abilities associated with working memory. Students with specific reading disabilities have deficits in phonological processing and storage (Schuchardt et al., 2008). Further evidence suggests that these children also experience deficits in central executive functioning, but when the demand for phonological processing is controlled for in the central executive memory tasks, this deficit seems to disappear (Schuchardt et al., 2008). For children with math learning disabilities empirical evidence suggests that the visual-spatial sketchpad and the central executive seem to be particularly impaired (Schuchardt et al., 2008). Therefore, executive functioning deficits appear to be more negatively impacted for children with learning disabilities in math.

During the creation of the McCloskey Executive Functions Scales (MEFS; McCloskey, 2016), ratings were obtained for clinical samples, and paired with nonclinical matched controls for comparison. Data was conducted for a sample of 49 students diagnosed with a learning disability. Relative to all clinical groups except Speech/Language, the Learning Disabilities group had lower percentages of deficits for Attention and Engagement in the Academic Arena and for Attention, Engagement, and Optimization in the Self/Social Arena. The highest percentages of deficits for the Learning Disabilities group were found for the Optimization,

Efficiency, Memory, Inquiry, and Solution Clusters within the Academic Arena. Also, for all seven Clusters, percentages of deficits were higher within the Academic Arena than within the Self/Social Arena.

ADHD and SLD.

The high rate of comorbidity with attention deficit and hyperactivity disorders indicates that there may be similar cognitive disabilities. A recent review taking a total of 17 studies published between 2001 and 2011 into account found relatively high comorbidity of learning disorders and ADHD, with 31% to 45% of students with ADHD having learning disorders and vice versa (Dupaul, Gormley, & Laracy, 2012).

There is evidence that working memory deficits underly both learning disorders and attention deficit disorders. Poor working memory has been found to be closely associated both with low academic achievement, motivation, and engagement (Dupaul et al., 2012). Furthermore, McCloskey (2016), identified that attention skill deficits are more prominent in the Academic Arena than in the Self/Social Arena for the Learning Disabilities and ADHD groups.

Although there is some comorbidity of ADHD and LD in the population, many students classified as learning disabled do not have a comorbid diagnosis of ADHD (McCloksey, 2016). In a study by Visalakshi and Thenmozhi (2011), participants were unmedicated at the time of testing and were administered three tests of executive function and attention, (letter cancellation, digit vigilance, triads task, and stroop colour word test), the empirical evidence suggests children with LD have better inhibition control than children with LD-ADHD, which might be because of the presence of ADHD behavior. Therefore, executive functioning deficits with inhibition may be more associated with ADHD.

Education

According to the National Center for Educational Statistics, students diagnosed with specific learning disabilities and ADHD constitute 48% of all students in special education. If an individual qualifies for special education, the student receives an Individualized Education Program (IEP). The IEP is a written document that includes specific interventions and goals for the child based on the child's current level of performance and needs. The IEP states the educational placement, and it specifies which services will be granted to the individual.

The National Center for Educational Statistics identified that approximately 70% of students with specific learning disabilities and 65% of students with 'Other Health Impairments' spend most of the school day in general education classes (McFarland et al., 2018). Therefore, general education teachers are frequently responsible for providing students diagnosed with SLD and ADHD an appropriate education. It is important that both special education and regular education teachers are familiar with the executive function deficits and appropriate evidence-based interventions for students with SLD and ADHD.

Intervention

SLD and intervention.

Once a student has been identified with SLD, there are various manifestations of the disorder which impacts the intervention required to remedy the dysfunction. There are learning disorders in math (Dyscalculia), reading (Dyslexia), writing (Dysgraphia), oral expression, and nonverbal learning disorders (DSM-V, 2013).

Targeted intervention is required for the student's specific subtype of SLD as indicated by the psychological processing or academic area of weakness. The umbrella term for SLD in reading is Dyslexia. However, there are four general subtypes of reading disorders; dysphonetic

dyslexia, surface dyslexia, mixed dyslexia, and reading comprehension deficits (Feifer, 2011; Feifer & Della Toffalo, 2007). Each form of SLD reading disorder can benefit from specific, evidence-based interventions.

Dysphonetic dyslexia is characterized by the reader's inability to use a phonological route to bridge letters and sounds, which results in guessing words based on initial letters or difficulty with rapid reading. Early intervention emphasizing the development of phonemic awareness and phonological processing is vital to remediating this type of reading deficiency. In one study a fluency-based reading program called Reading Acceleration Program (RAP) was used for 20 minutes per day over a 4-week period for children ages 8 through 12 years with reading disorders. After the four weeks, there was a shift of metabolic activity from the right to the left hemisphere, which is the dominant hemisphere for reading and linguistic-related activities following just 4 weeks of training (Horowitz-Kraus et al., 2014). Targeted reading intervention can make changes in the brain metabolism.

Surface Dyslexia is when students rely heavily on phonological properties and tend to sound out words letter-by-letter (Feifer, 2011). Students with surface dyslexia tend not to use orthographical or spatial properties of the visual word form, which makes fluency very difficult. Interventions for children with surface dyslexia should focus on enhancing automaticity, pacing, and fluency skills. There should be emphasis on contextual-based reading.

Mixed dyslexia is the most severe type of reading disability as it is characterized by readers that have difficulty with a combination of phonological processing skills, slower rapid and automatic word-recognition skills, inconsistent language-comprehension skills, and unique error patterns when reading. Reading comprehension deficit subtype is comprised of students that struggle to derive meaning from print despite well-developed reading mechanics. This

specific subtype of reading disorder requires an examination of executive functioning skills; specifically, working memory (Reiter, Tucha, & Lange, 2005). Targeted interventions should help students with reading comprehension deficits to increase self-organization and summarize information more effectively and to read with a plan to identify important details.

There is no consistent definition for Math Learning Disabilities (MLD) (Lewis & Fisher, 2016); however, recently subtypes of MLD have been identified. Specific skills related to MLD include: non-symbolic and symbolic skills rooted in numerical processing. There is a strong correlation between mathematics and executive functioning (Clements & Sarama, 2014). Math achievement requires the following executive functioning skills: ability to maintain attention, cognitive flexibility, inhibitory control, and working memory (Alfonso and Flanagan, 2018). Students with poor working memory are at the greatest risk for low math achievement (Alloway & Alloway, 2010). Effective math intervention should include active engagement, accountability for teachers and students, explicit instruction in steps required for identifying problems and solutions, and direct instruction of math concepts (Fuchs & Fuchs, 2001). More intensive math intervention requires explicit and systematic instruction for word problems, number combinations, and fractions. Additionally, carefully sequenced instruction that builds on a student's prior knowledge helps reduce learning challenges. The student requires many opportunities for skills mastery through drill and practice. Students with MLD also require positive reinforcement and motivation to persevere through challenging academic demands (Fuchs & Fuchs, 2001).

Writing disabilities are complex and require fine motor skill, knowledge of writing conventions, oral language, and reasoning (Berninger & Richards, 2002). The writing process includes planning, drafting, sharing, revising, editing, and evaluating. There are many executive

functioning skills required to complete the writing process; including, self-regulating, cognitive flexibility, and perseverance. One evidence-based approach to writing instruction is called self-regulated strategy development (Graham & Harris, 2009). Students are taught strategies and techniques to self-monitor their writing behavior. Students are taught the following steps in the SRSD process: activate background knowledge, discuss writing goals and strategies, teacher models the strategy, students memorizes the strategy steps, teacher scaffolds, prompts, and guides students as students apply writing strategies, and finally students use the writing strategies independently and correct their own behavior. Students with writing disabilities require instruction that is individualized, sequential, explicit, and systematic (Alfonso & Flanagan, 2018).

Students with SLD may have deficits in oral language and listening comprehension. Attention capacities and executive functions are vital cognitive correlates for language development and disorders. The executive function deficits related to SLD in language include selective attention, cognitive inhibition, control of working memory, and cognitive flexibility (Alfonso and Flanagan, 2018). These skills help individuals with complex tasks required for coordination of multiple domains and levels of language skills. Curriculum-based language assessments identify if the students has the language skills to learn an aspect of the curriculum. Identification of a student's strengths and weaknesses in listening comprehension and oral language is vital to knowing what to do next for students with SLD (Alfonso & Flanagan, 2018).

For children with NLD, executive functioning weaknesses have been identified within working memory, sequencing, planning, organization and cognitive flexibility (Alfonso & Flanagan, 2018). Schools do not classify students with NLD and do not provide special education service unless there is a significant problem in mathematics. Executive function

deficits may contribute to NLD more than visual-spatial difficulties; therefore, executive functioning interventions may be most effective for students with NLD.

ADHD and intervention.

Behavior parent training (BPT).

BPT is one of the most well-research psychosocial interventions for ADHD (Eyberg, Nelson, & Boggs, 2008). Family-based interventions, such as parent training, have demonstrated efficacy in the reduction of problem behaviors (Chronis, Jones & Raggi, 2006). Poor parent-child interactions and development can lead to increased risk for development of Oppositional Defiant Disorder and Conduct Disorder. Parent training generally focuses on instructing the adults on how to utilize behavior modification techniques to alter the child's behavior. Parents may receive psychoeducation about ADHD and behavior principles. Parents are instructed on the ABC model (Antecedent-Behavior-Consequence) and are encouraged to identify their child's target behaviors. Parents may also be instructed on positive attending to expected behaviors, planned ignoring of problem behavior, effective commands, and incentive systems (Barkley, 2018).

Social skills training for students with ADHD.

Students with ADHD often have problems in peer relationships; such as, poor social behavior and/or being regarded poorly by peers (Dirks, Treat, & Weersing, 2007). Inattention can lead to students with ADHD to miss social cues, demonstrate disruptive/offensive behaviors, and disengagement from peers (Mikami, Ransone & Calhoun, 2011). There are various social skills training curricula for students with ADHD; however, many of the programs have similar underlying factors (Nixon, 2001). The program is typically delivered to a group of students for approximately 60 minutes per session for approximately 8-12 weeks. Topics of instruction consist of: sharing, making conversation, joining new groups of peers, following rules while

playing games, taking turns, calming down when upset, and identifying emotions (Pfiffner, 2008). Instruction may include role play, direct instruction by a trained clinician, and generalization outside of the therapeutic context with homework assignments. Generalization of skills may be enhanced if parents are trained as friendships coaches (DuPaul & Eckert, 1994). Parent training groups that explicitly teach parents how to reinforce their child's good social behavior may help as they are more likely to be present during the child's natural peer interactions (Pfiffner, 2008).

Academic and behavioral interventions in schools.

Students with ADHD have deficits in self-regulation, motivation, inhibition and executive functioning (Barkley, 2018). Children with ADHD that require more external structure should be provided interventions aimed at executive weaknesses and motivational deficiencies. Middle and high school students benefit from psychoeducation on the nature of their condition. The counseling may help students become more aware and accepting of supports and services. School-based accommodations based on the need of the student should be identified (Barkely, 2018).

Students with ADHD may benefit from organizational skills training. The training requires direct instruction of specific organization skills; such as, identifying materials needs, track time required to complete the task, break tasks down into stops, and self-monitor steps completed using checklists. Rewards are typically provided for completion of organizational goals. There are various programs that have developed organizational programs for upper elementary school, middle school, and high schools. A well-known organizational skills training program for middle school students is called the Homework, Organization, and Planning Skills interventions (HOPS). It was developed by Langberg and colleagues (2012) and includes 16

sessions over 11 weeks. There are also two parent sessions. According to the HOPS manual, outcome studies suggest that the intervention can be effectively implemented with relatively little training by school-based mental health professionals.

Self-regulation interventions, which include self-monitoring and self-reinforcement, have had some success for students with ADHD (Reid, Trout, & Schartz, 2005). These strategies require the student to monitor and evaluate their own academic and social behavior and reward themselves. Teachers typically train students to monitor and reward their behavior. The students may be prompted to observe their behavior with a verbal or non-verbal cue. Accuracy of student ratings is usually assessed by comparing these ratings with teacher's records. Self-monitoring and self-regulation strategies are the most promising self-regulation interventions (Barkely, 2018).

Many students with ADHD have problems completing homework on a consistent basis. Homework strategies can be an important component to help students with ADHD improve their academic achievement. Power and colleagues (2001) developed a homework strategy program called Homework Success. The program consists of seven, 90-minute sessions for parents that teaches goal-setting, contingency management procedures and encourages consistent homework performance. Topics include creating a homework ritual, providing positive reinforcement, managing time, goal setting, and anticipating future homework problems.

The core accommodations and interventions for ADHD in schools consist of: altering the physical classroom layout and structure, modifying academic tasks and using computer assisted instruction, improving academic readiness skills, altering teacher delivered consequences for appropriate and inappropriate conduct, collaborating with parents to enhance in-school outcomes and promote generalization outside of school, using peers to facilitate academic success and

behavioral control, developing home-based reinforcement programs (Daily report cards), striving to enhance self-monitoring and self-management through self-regulation approaches, and modifying these approaches based on the developmental level of the child or teen (Barkley, 2018). Formal special educational services can be delivered under the IDEA and Section 504 may also be required for a child with ADHD if accommodations are not sufficient.

ADHD and pharmacotherapy.

Treatment for ADHD has included various types of medication; most notably are stimulants. Methylphenidate is one such medication that has proven to be effective in improving ADHD related symptoms in some individuals (Van der Oord, Prins, Ossterlaan, & Emmelkamp, 2008). According to Spencer et al., (1996) approximately 70% of children with ADHD respond to psychostimulant treatment.

Despite the efficacy of psychostimulants, like methylphenidate, various disadvantages present regarding side effects frequently associated with these medications (Schachter, Pham, King, Langford, & Moher, 2001). Children reported various concerns, including decreased appetite and insomnia. Some studies have indicated that although stimulants frequently provide successful results in the short term, little evidence supports long-term benefits regarding academic performance and social skills (Schachter et al., 2002). This lack of substantiated long-term evidence supports the notion that psychotropic treatment should be utilized in conjunction with other treatment options and methodologies (Van der Oord et al., 2008).

Neurofeedback.

A treatment for developmental and behavioral disorders is neurofeedback, a neural based practice that is reportedly used by more than 1,500 practitioners (Butnik, 2005). This treatment is based under the assumption that ADHD impacts an individual's neural regulation and under-

arousal of the frontal cortex, which can be altered via behavioral methods. The efficacy of neurofeedback is due to operant conditioning of bioelectrical neuro-regulation that results in the patient receiving positive feedback following administration of the treatment (Toplak, Connors, Shuster, Knezevic, & Parks 2008). Patients who undergo neurofeedback work with a clinician who records and monitors neural activity while the participant engages in a computer program that resembles a video game (Toplak et al., 2008). Long-term changes were reported by 30% of people with ADHD who received 20 sessions of neurofeedback (Fox, Tharp, & Fox, 2005). This treatment can be an effective tool to help find families an appropriate treatment for their children with ADHD.

Mindfulness.

The implication of behavioral and cognitive strategies can prove to be helpful in decreasing the implications of EF deficits. A strategy that has been shown to increase various EF deficits is mindfulness. Mindfulness and meditation practices focus on allowing the individual to increase their awareness of their own body and mindset and how that can affect their actions and emotions. The practice of mindfulness and meditation was evaluated within various subdomain of EF (Gallant, 2016). Results indicated that the implications of this strategy most closely affect an individual's ability to inhibit impulses. Individuals who have issues related to impulse control, such as those with ADHD, showed improvement in these areas. As inhibition requires numerous mental faculties to properly occur, the need to sequence events appropriately to control inhibition can become significant (Gallant, 2016).

Cognitive behavior therapy.

Cognitive therapy was originally created by Aaron T. Beck in the 1960's. This modality was originally generated to help treat patients with depression in a short-term and structured setting (Beck, 1995). When Cognitive Therapy added the component of altering one's behavior, the treatment became known as Cognitive Behavioral Therapy (CBT; Beck, 1995). Through traditional CBT, clients and clinicians work together to create goals for the patient to achieve throughout the therapy sessions. One vital goal in CBT is known as cognitive restructuring. When clients present with various pathologies linked to their thoughts and emotions, those thoughts are connected to an underlying schema that may trigger negative thoughts and feelings (Beck, 1995). These inappropriate thoughts can cause the symptoms of the individual's pathology.

Individuals with ADHD can develop various comorbid issues, including anxiety, depression, poor self-esteem, and low self-efficacy (Newark & Stieglitz, 2010). Their treatment will generally focus on identifying and modifying cognitive distortions, increasing use of coping strategies, using behavioral modification, and managing their mood and anxiety-related symptoms (Mongia, & Hechtman, 2012).

Multimodal treatment.

A combination of different treatment methods is crucial to successful treatment of patients with ADHD (Barkley, 2018). A combination of pharmacologic, cognitive-behavioral, and neural based treatment showed progress in the patients served. It is known that individuals with ADHD indicate a physiological and chemical imbalance that manifests symptoms (Van der Oord et al., 2008). Provision of psychotropic medication functions to improve the neurologic components, while neurofeedback uses behavioral treatments to condition the brain into alternative methods of functionality. CBT focuses largely on having individuals utilize cognitive

skills to examine and reflect on their own behavior, while the behavioral component uses basic principles to refocus and assist in behavior modification (Barkley, 2018).

Discussion and Direction

Across various settings, the behavioral and cognitive implications for those with ADHD or SLD can result in various issues related to their academic, social, or behavioral growth. In some cases, EFs may play a crucial role in the execution of these variable issues. The purpose of the study is to examine the EF profiles of students with SLD and ADHD and analyze the similarities and differences between the two. Within the school-based setting, these individuals often present with variable difficulties regarding their behavior, academic achievement, and attention to task. Often, viewing these difficulties from the EF lens may highlight methods to assist these students in their improvement of their daily functioning.

The research presented will provide a groundwork to further investigate the EF nuances and differences that could be utilized to direct treatment of individuals with the aforementioned disorders. Although a high degree of similarities between SLD and ADHD may exist, the research examined in this chapter suggests that there may be significant differences in the specific EC deficits exhibited by individuals diagnosed with ADHD or SLD that could assist in developing more appropriate treatment methods targeted specifically for individuals in these diagnostic groups.

Research Questions and Hypotheses

This study will analyze Composite scores and item level ratings obtained during the standardization of the MEFS to explore the following research questions:

1. What are the similarities and differences between the pattern of EC strengths and/or deficits resulting from teacher ratings of a group of students diagnosed with ADHD and

the pattern of EC strengths and/or deficits resulting from teacher ratings of a demographically-matched control group of students with no clinical diagnosis?

It is hypothesized that the ADHD groups will demonstrate executive deficits at a greater rate than their non-clinical peers. Notably, it is hypothesized that the highest proportion of deficits will affect the academic functioning of the ADHD-diagnosed group.

2. What are the similarities and differences between the pattern of EC strengths and/or deficits resulting from teacher ratings of a group of students diagnosed with SLD and the pattern of EC strengths and/or deficits resulting from teacher ratings of a demographically-matched control group of students with no clinical diagnosis?

   It is hypothesized that the results of the research study will indicate that the SLD-diagnosed group will demonstrate a high frequency of executive deficit than their nonclinical matched peers. Specifically, it is hypothesized that the SLD group will demonstrate the highest frequency of deficits regarding ECs that affect their academic functioning.

3. What are the similarities and differences between the pattern of EC strengths and/or deficits resulting from teacher ratings of a group of students diagnosed with SLD and the pattern of EC strengths and/or deficits resulting from teacher ratings of a group of students diagnosed with ADHD?

   It is hypothesized that differences will exist between the SLD and ADHD groups, specifically with regard to the comparison between the Academic and Self/Social arenas. It is hypothesized that the ADHD group will have a greater number of EF and EC deficits

in the Self/Social arena, while the SLD group will show deficits mostly in the Academic arena.

CHAPTER 3

METHODOLOGY

This study will examine archival data collected during the standardization of the McCloskey Executive Functions Scale Teacher Report Form (MEFS-TR, Appendix A).

Source of Data

The source of the archival data to be used in this study are the MEFS-TR item raw score file for the ADHD clinical sample and a matched control sample and for the SLD clinical sample and a matched control sample. This file was created from the standardization data collection file. The data were collected during the scale standardization project during the 2013-2014 and 2014-2015 school years.

Data

The data used for this study are the teacher ratings of samples of students diagnosed with ADHD and SLD and the teacher ratings of student samples of nonclinical, demographically-matched controls collected with the MEFS-TR. Teacher ratings reflected teacher perceptions of the frequency and effectiveness of students' performance of behaviors that reflected the degree of use or disuse of executive functions and executive skills.

Norming data for the MEFs was collected between March 2014 and April 2015. The sample included 1,127 subjects from 167 communities in 29 states in the United States. A total of 255 teachers completed the ratings for the 1,127 subjects. Of the 1,127 students that were rated by teachers, 103 were diagnosed with ADHD (47 medicated and 56 nonmedicated) and 38 were diagnosed with SLD. Control samples were obtained by selecting the ratings of a nonclinical sample of standardization cases that matched the clinical sample cases using the

demographic data variables of age, gender, ethnicity, and academic skills rankings provided by teachers.

Teachers rated each student with a pool of 104 items that represented 31 self-regulation executive functions organized into 7 self-regulation clusters, and 3 facets of self-realization and 2 facets of self-determination (see Appendix A for the MEFS-TR form).

Self-regulation items were rated on a 6-point scale ranging from 0 to 5. Appendix B in the Appendices section shows the MEFS-TR rating rubric.

Characteristics of the Teacher Raters

The teachers that provided the MEFS-TR ratings were regular and special education teachers from across the United States. A total of 255 teachers completed ratings on 1,127 children and adolescents who were their students. Of the 255 teachers, 11.4 percent were male, and 88.6 percent were female.

Variables Used in the Analyses

The variables to be used in the data analyses include: 1. Raw score sums based on teacher ratings for 7 self-regulation executive function clusters (Attention, Engagement, Optimization, Efficiency, Memory, Inquiry, and Solution), 2. raw score sums based on teacher ratings for each of the 31 self-regulation executive functions, and 3. raw scores based on teacher ratings for each of the 104 items of the MEFS.

Psychometric Properties of MEFS

Item ratings.

Each MEFS **item** was rated by teachers using six potential responses:

5-AA = ALMOST ALWAYS does it on own without prompting

4-F = FREQUENTLY does it on own without prompting

3-S = SELDOM does it on own without prompting

2-AP = Does it, but only AFTER PROMPTING

1-DA = Only does it with DIRECT ASSISTANCE

0-UA = UNABLE to do it even with ASSISTANCE

The rating options for the items comprising the Self-Realization and Self-Determination facets were:

3-VO = Does this VERY OFTEN

2-O = Does this OFTEN

1-S = Does this SOMETIMES, but not much

0-N = NEVER does this

Evidence of reliability.

Teacher ratings were examined using a measure of inconsistent responding. The MEFS Inconsistency scale is composed of six self-regulation items that were altered slightly in wording. The original items and the slightly altered items were included on the rating form but placed in different locations. Ratings on the original item and the slightly altered item were compared to obtain a rating difference score. The absolute values of these rating difference scores were summed across all six pairs of consistency items to produce the score for the Inconsistency Index. An acceptable level of variation that was not likely to be cause for concern about the consistency of teacher ratings was established (raw score of 6). All teacher ratings of the consistency items for students in the ADHD and SLD clinical samples and students in the matched control samples produced Consistency Index scores within the acceptable level.

The MEFS manual also reports internal consistency and split-half reliability coefficients for the 7 self-regulation clusters and 14 sub-clusters (each self-regulation cluster was divided

into items assessing the Self/Social Arena and items assessing the Academic Arena) and the Self-Realization and Self-Determination composites by six age groups. The large majority of these coefficients were above .90 and no coefficient was less than .85. Test-retest reliability coefficients also were provided for the cluster, subcluster, and composite scores, with all but two of these coefficients at or greater than .80.

Statistical analyses.

Frequency counts will be generated for the item scores obtained by the clinical groups and the matched controls. Differences between clinical and matched controls and the differences between ADHD and SLD samples will be described in detail. Differences between the ratings of the clinical samples and the matched controls will be tested for statistical significance. This will be accomplished by calculating the percentage of students in each sample that were rated as exhibiting executive deficits (ratings of 0-3). The proportion of the clinical group rated as exhibiting executive deficits will be compared to the proportion of nonclinical matched controls rated as exhibiting executive deficits using a Fisher's Exact Test analysis. This procedure will be repeated to compare the ratings of the ADHD group with the ratings of the SLD group.

CHAPTER 4

RESULTS

The results of the analyses of teacher ratings of the executive capacities of groups of clinical and nonclinical students using the McCloskey Executive Functions Scale Teacher Report form (MEFS-TR) will be reviewed in this section.

Demographics

The data used for this study includes the MEFS-TR teacher ratings of samples of students diagnosed with ADHD (ADHD group) at the time of teacher rating (n = 103), students classified as LD (LD group) at the time of teacher rating (n = 48) and the teacher ratings of student samples of nonclinical, demographically-matched controls (ADHD matched controls n = 103; LD matched controls n = 48).

Table 4.1 shows the demographic characteristics of the ADHD and LD groups and their respective matched control groups based on the variables used to match the samples. Table 4.2 shows the grade in school of the students in the ADHD and LD groups and their respective matched control groups

Table 4.1

Demographic Characteristics of ADHD and LD Groups and Their Respective Matched Control Groups Based on the Variables Used to Match the Samples

	ADHD Sample	Matched Control Sample	LD Sample	Matched Control Sample
Gender				
Female	32	32	23	21
Male	71	71	25	27
Total	103	103	48	48
Ethnicity				
African-American	20	21	12	12
Hispanic	17	17	14	15

White	63	62	20	19
Asian	3	3	2	2
Total	103	103	48	48
Region				
Midwest	8	16	4	17
Northeast	26	21	17	8
South	45	40	17	13
West	24	26	10	10
Total	103	103	48	48
Academic Skills Level				
Above Average	14	14	3	5
Average	59	75	11	22
Below Average	30	14	34	21
Total	103	103	48	48
Gender of Teacher Rater				
Female	92	90	44	42
Male	11	13	4	6
Total	103	103	48	48
Student Age				
5	1	1	1	1
6	8	8	4	4
7	12	12	3	3
8	7	7	5	5
9	16	16	4	4
10	13	13	4	4
11	3	3	6	6
12	3	4	3	3
13	2	2	4	4
14	10	8	0	2
15	10	9	4	2
16	5	9	2	4
17	11	8	4	3
18	2	3	4	3
Total	103	103	48	48

Table 4.2

Grade in School of the Students in the ADHD and LD Groups and Their Respective Matched Control Groups

	ADHD Sample	ADHD Matched Control Sample	LD Sample	LD Matched Control Sample
Student Grade				
K	7	5	5	3
1	8	9	4	4
2	11	10	2	2
3	12	17	6	6
4	15	6	6	4
5	5	10	3	4
6	3	5	4	6
7	3	3	4	2
8	3	10	0	3
9	15	7	3	3
10	9	7	2	3
11	4	7	5	5
12	8	7	4	3
Total	103	103	48	48

Research Questions

The research questions for this study were addressed by 1) comparing the teacher ratings of the ADHD group with the teacher ratings of a nonclinical matched control sample, 2) comparing the teacher ratings of the LD group with the teacher ratings of a nonclinical matched control sample, and 3) comparing the teacher ratings of the ADHD group with the teacher ratings of the LD group. The analyses were conducted using the MEFS-TR individual item ratings of the executive capacities that comprise the Self-Regulation, Self-Realization and Self-Determination Clusters. Frequency counts were generated for the item scores obtained by the clinical groups and the matched controls. For each of the three comparative analyses, the

proportions of students who were rated by teachers as exhibiting Executive Function deficits (EFDs; rated as seldom doing it unless told to do so) or Executive Skill deficits (ESDs; rated as unable to do it even when shown how) were tested for statistical significance using Fisher's Exact z test. Appendix B contains the results of the statistical analyses for each item within each EC Cluster. Appendix C provides the percentage of each type of deficit for each item within each EC cluster. Table 4.3 shows the specific self-regulation ECs assessed within each self-regulation cluster according to Arena of Involvement.

Table 4.3

Self-Regulation Executive Capacities Assessed Within Each Self-Regulation Cluster

Self-Regulation Cluster	Self-Regulation Executive Capacity	Academic Arena	Self/Social Arena
Attention	Aware	1	1
	Focus	1	1
	Sustain	1	1
Engagement	Effort	1	1
	Initiate	1	1
	Inhibit	1	6
	Stop	1	2
	Pause	1	1
	Flexible	2	2
	Shift	1	1
Optimization	Monitor	2	2
	Modulate	2	3
	Correct	1	1
	Balance	1	2
Efficiency	Sense Time	1	1
	Pace	1	1
	Routines	7	1
	Sequence	1	1
Memory	Hold/Manipulate	1	1
	Store/Retrieve	2	3
Inquiry	Gauge	1	1
	Anticipate	1	2
	Estimate Time	1	1
	Analyze	1	1
	Compare/Evaluate	1	1
Solution	Generate	1	1

	Associate	1	1
	Organize	1	1
	Plan	1	2
	Prioritize	1	1
	Decide	1	1

Research question 1.

What are the similarities and differences between the pattern of EF deficits resulting from teacher ratings of a group of students diagnosed with ADHD and the pattern of EF deficits resulting from teacher ratings of a demographically-matched control group of students with no clinical diagnosis?

Research question 2.

What are the similarities and differences between the pattern of EF deficits resulting from teacher ratings of a group of students diagnosed with LD and the pattern of EF deficits resulting from teacher ratings of a demographically-matched control group of students with no clinical diagnosis?

Research question 3.

What are the similarities and differences between the pattern of EF deficits resulting from teacher ratings of a group of students diagnosed with ADHD in comparison to the pattern of EF deficits resulting from teacher ratings of a group of students diagnosed with LD?

Hypothesized Results

Given the literature available on ADHD, LD, and executive capacities, it was hypothesized that the teacher ratings using the MEFS would indicate that the ADHD group would be rated with more deficits than the non-clinical control group. It also was hypothesized, based on the HMEC theory, that the ADHD group would exhibit more EC deficits in the Academic Arena (symbol system) than in the Self/Social arena. Likewise, the greatest number of

EC deficit ratings for the ADHD group would occur with the Focus, Sustain, Inhibit and Modulate self-regulation executive capacities. Additionally, although other executive capacities may be rated as deficient, these additional deficiencies would not occur as frequently as those reported for the core four capacities of Focus, Sustain, Inhibit, and Modulate.

It was hypothesized that the teacher ratings using the MEFS would indicate that the LD group would be rated with more EC deficits than the non-clinical group, but these deficits would be fewer in number than those identified for the ADHD group. It also was hypothesized based on the HMEC theory, that the LD group would exhibit more EC deficits than the non-clinical group for self-regulation executive capacities in the Optimization, Efficiency and Memory Clusters, and that these deficits would be more frequent within the Academic Arena than within the Self/Social Arena. Additionally, although other executive capacities may be rated as deficient, these additional deficiencies would not occur as frequently as those reported for the Optimization, Efficiency and Memory Clusters. Finally, it was hypothesized that the ADHD group would be rated with more EC deficits in the Attention and Engagement Clusters than the LD group. It also was hypothesized that the LD group would be rated with more EC deficits in the Optimization, Efficiency and Memory Clusters than the ADHD group.

Attention Cluster Results

Within the Attention Cluster, 3 items are included in the Academic Arena and 3 items are included in the Self/Social Arena. Table 4.4 shows a summary of the significant differences that were identified when comparing proportions of students who were rated by teachers as exhibiting EFDs or ESDs on the items of the Attention Cluster. Proportion comparisons were made between the clinical groups and their respective matched control samples and between the

two clinical samples. The results of the statistical analyses completed for each Attention Cluster item are provided in Appendix B.

Table 4.4

Summary of the Significant Differences in Teacher Ratings of EFDs and ESDs When Comparing the ADHD and LD Groups With Their Respective Matched Controls and When Comparing the ADHD Group With the LD Group on the MEFS Attention Cluster Items.

Type of Deficit	Group Comparisons							
	ADHD>Controls		LD > Controls		ADHD>LD		LD>ADHD	
	Number of Attention Cluster Items by Arena							
	ACA	S/S	ACA	S/S	ACA	S/S	ACA	S/S
	3 Items	3 Items	3 Items	3 Items	3 Items	3 Items	3 Items	3 Items
	Number of Items Showing Significant Differences							
EFD	3 (100%)	3 (100%)	0	0	0	0	0	0
ESD	3 (100%)	0	0	0	0	0	0	0

Table 4.5 shows the items of the Attention Cluster and the percentages of students in each group that were rated as having an EFD or an ESD.

Table 4.5

Percentages of EFD and ESD Teacher Ratings for the Clinical and Control Groups on the MEFS Attention Cluster Items.

	Executive Function Deficit (EFD)			
	Control Groups		Clinical Groups	
ATTENTION	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an EFD			
Aware with school tasks	22%	40%	44%	47%*
Focused with school tasks	31%	46%	50%	57%*
Sustains with school tasks	33%	48%	42%	61%*
Self/Social Arena				
Aware during social interactions	15%	25%	31%	31%*
Focused in social interactions	18%	23%	23%	32%*
Sustains with social interactions	18%	19%	27%	40%*

Executive Skill Deficit (ESD)

	Control Groups		Clinical Groups	
ATTENTION	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an ESD			
Aware with school tasks	0%	4%	10%	10%*
Focused with school tasks	1%	4%	14%	13%*
Sustains with school tasks	2%	6%	23%	20%*
Self/Social Arena				
Aware during social interactions	1%	0%	4%	9%
Focused in social interactions	0%	0%	10%	7%
Sustains with social interactions	0%	0%	8%	9%

Note. Clinical Group % Significantly Greater than Control Group %.

ADHD group vs control group.

As predicted, the ADHD group had significantly larger proportions of students than the matched control group that were rated as having an EFD or an ESD within the Academic Arena for the items assessing all three of the Attention Cluster self-regulation capacities (Perceive, Focus, and Sustain). In addition however, the ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an EFD within the Self/Social Arena for the items assessing all three of the Attention Cluster self-regulation capacities of Perceive, Focus, and Sustain.

LD group vs control group.

As predicted, when comparing teacher ratings of the LD- group and the matched control group, there were no significant differences between the percentage of ratings indicating EFDs or ESDs within either the Academic Arena or the Self/Social Arena of the Attention Cluster.

ADHD group vs LD group.

When comparing teacher ratings of the ADHD group with teacher ratings of the LD group, no significant differences were found when examining EFD ratings or ESD ratings within either the Academic Arena or the Self/Social Arena. However, it was anticipated that the ADHD

group would exhibit significantly larger proportions of students rated as having an EFD or an ESD than the LD group within the Academic Arena of the Attention Cluster.

Engagement Cluster Results

Within the Engagement Cluster, 8 items are included in the Academic Arena and 14 items are included in the Self/Social Arena. Table 4.6 shows a summary of the significant differences that were identified when comparing proportions of students who were rated by teachers as exhibiting EFDs or ESDs on the items of the Engagement Cluster. Proportion comparisons were made between the clinical groups and their respective matched control samples and between the two clinical samples. The results of the statistical analyses completed for each Engagement Cluster item are provided in Appendix B.

Table 4.6

Summary of the Significant Differences in Teacher Ratings of EFDs, and ESDs When Comparing ADHD-Diagnosed and LD-Classified Groups With Matched Controls and When Comparing the ADHD-Diagnosed Group With the LD-Classified Group on the MEFS Engagement Cluster Items.

Type of Deficit	Group Comparisons							
	ADHD>Controls		LD > Controls		ADHD>LD		LD>ADHD	
	Number of Engagement Cluster Items by Arena							
	ACA	S/S	ACA	S/S	ACA	S/S	ACA	S/S
	8 Items	14 Items	8 Items	14 Items	8 Items	14 Items	8 Items	14 Items
	Number of Items Showing Significant Differences							
EFD	8 (100%)	10 (71%)	1 (13%)	1 (7%)	2 (25%)	0	0	0
ESD	6 (75%)	7 (50%)	0	0	0	0	0	0

Table 4.7 shows the items of the Engagement Cluster and the percentages of students in each group that were rated as having an EFD or an ESD.

Table 4.7

Percentages of EFD and ESD Teacher Ratings for the Clinical and Control Groups on the MEFS Engagement Cluster Items

	Executive Function Deficit (EFD)			
	Control Groups		Clinical Groups	
ENGAGEMENT	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an EFD			
Starts school tasks	25%	0%	46%*	53%*
Effortful with school tasks	28%	46%	46%	52%*
Inhibits with challenging school tasks	16%	23%	15%	45%*+
Stops playing a game	26%	31%	25%	44%*
Returns to school tasks	20%	35%	46%	51%*
Tries different ways for school tasks	23%	38%	38%	49%*
Accepts changes in school	14%	19%	10%	28%*
Shifts for school tasks	23%	27%	21%	46%*+
Self/Social Arena				
Starts social interactions	17%	17%	35%	30%*
Effortful in social interactions	17%	19%	42%	28%
Waits turn	16%	10%	21%	40%*
Thinks before acting	30%	27%	29%	43%
Refrains from aggression	10%	13%	15%	15%
Inhibits thoughtless comments	21%	25%	19%	38%*
Inhibits in frustrating situations	18%	19%	21%	41%*
Inhibits in social situations	20%	19%	23%	42%*
Stops talking about one thing	24%	27%	31%	45%*
Stops annoying others	20%	17%	29%	43%*
Returns in social interactions	15%	10%	38%*	38%*
Accept good ideas from others	15%	21%	21%	35%*
Accepts changes in social patterns	11%	17%	17%	18%
Shifts in social interactions	13%	15%	21%	38%*

	Executive Skill Deficit (ESD)			
	Control Groups		Clinical Groups	
ENGAGEMENT	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an ESD			

Starts school tasks	3%	0%	10%	17%*
Effortful with school tasks	4%	6%	18%	19%*
Inhibits with challenging school tasks	3%	2%	17%	11%
Stops playing a game	2%	0%	13%	18%*
Returns to school tasks	3%	2%	10%	17%*
Tries different ways for school tasks	2%	2%	13%	17%*
Accepts changes in school	0%	0%	4%	6%
Shifts for school tasks	1%	4%	13%	16%*
Self/Social Arena				
Starts social interactions	0%	0%	6%	9%
Effortful in social interactions	1%	0%	4%	8%
Waits turn	1%	2%	2%	11%*
Thinks before acting	1%	4%	12%	21%*
Refrains from aggression	1%	2%	6%	10%
Inhibits thoughtless comments	0%	0%	15%	11%*
Inhibits in frustrating situations	3%	2%	13%	13%
Inhibits in social situations	3%	2%	15%	11%
Stops talking about one thing	0%	2%	8%	16%*
Stops annoying others	3%	2%	8%	20%*
Returns in social interactions	0%	0%	4%	11%*
Accept good ideas from others	0%	0%	10%	11%*
Accepts changes in social patterns	0%	0%	6%	6%
Shifts in social interactions	0%	2%	4%	9%

*Note.*Clinical Group % Significantly Greater than Control Group %.

ADHD group vs control group.

As predicted, the ADHD group had significantly larger proportions of students than the matched control group that were rated as having an EFD within the Academic Arena for all 8 of the items assessing the Engagement Cluster self-regulation capacities (Initiate, Effort, Inhibit, Stop, Pause, Flexible (2 of 2), Shift). The ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an ESD within the Academic Arena for 6 of the 8 items assessing the Engagement Cluster self-regulation capacities (Initiate, Effort, Stop, Pause, Flexible (1 of 2), and Shift).

In addition however, the ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an EFD within the Self/Social Arena for 10 of the 14 items assessing the Engagement Cluster self-regulation capacities of Initiate, Inhibit (4 of 6), Stop (2 of 2), Pause, Flexible (1 of 2), and Shift. Similarly, the ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an ESD within the Self/Social Arena for 7 of the 14 items assessing the Engagement Cluster self-regulation capacities of Initiate, Inhibit (3 of 6), Stop (2 of 2), Pause, and Flexible (1 of 2).

LD group vs control group.

When comparing teacher ratings of the LD group and a sample of matched controls, the LD group had a significantly greater percentage of ratings indicating an EFD than the students in the matched control group for only one item assessing the Academic Arena self-regulation capacity of Initiate. Similarly, within the Self/Social Arena the LD group had a significantly greater percentage of ratings indicating an EFD than the students in the matched control group for only one item assessing the self-regulation capacity of Pause. No significant differences were found between the ratings of the LD group and the control group in the number of ESD ratings for any of the 8 items within the Academic Arena or for any of the fourteen items within the Self/Social Arena.

ADHD group vs LD group.

When comparing teacher ratings of the ADHD group and the LD group, the ADHD group had a significantly greater percentage of ratings indicating an EFD than the students in the LD group for two of the eight items assessing the Academic Arena self-regulation capacities of Inhibit and Shift. No significant differences were found between the ratings of the ADHD group

and the LD group in the number of ESD ratings for any of the 14 items within the Self/Social Arena. Additionally, no significant differences were found between the ratings of the ADHD group and the LD group in the number of ESD ratings for any of the 8 items within the Academic Arena or for any of the fourteen items within the Self/Social Arena.

Although these findings are consistent with the initial hypothesis, the number of significant differences between the ADHD and LD groups was far fewer than anticipated.

Optimization Cluster Results

Within the Optimization Cluster, 6 items are included in the Academic Arena and 8 items are included in the Self/Social Arena. Table 4.8 shows a summary of the significant differences that were identified when comparing proportions of students who were rated by teachers as exhibiting EFDs or ESDs on the items of the Optimization Cluster. Proportion comparisons were made between the clinical groups and their respective matched control samples and between the two clinical samples. The results of the statistical analyses completed for each Optimization Cluster item are provided in Appendix B.

Table 4.8

Summary of the Significant Differences in Teacher Ratings of EFDs and ESDs When Comparing ADHD-Diagnosed and LD-Classified Groups With Matched Controls and When Comparing the ADHD-Diagnosed Group With the LD-Classified Group on the MEFS Optimization Cluster Items.

Type of Deficit	Group Comparisons							
	ADHD>Controls		LD > Controls		ADHD>LD		LD>ADHD	
	Number of Optimization Cluster Items by Arena							
	ACA	S/S	ACA	S/S	ACA	S/S	ACA	S/S
	6 Items	8 Items	6 Items	8 Items	6 Items	8 Items	6 Items	8 Items
	Number of Items Showing Significant Differences							
EFD	6 (100%)	8 (100%)	0	0	1 (17%)	2 (25%)	0	0
ESD	6	7	2	0	0	2	0	0

	(100%)	(88%)	(33%)			(25%)		

Table 4.9 shows the items of the Optimization Cluster and the percentages of students in each group that were rated as having an EFD or an ESD.

Table 4.9

Percentages of EFD and ESD Teacher Ratings for the Clinical and Control Groups on the MEFS Optimization Cluster Items

	Executive Function Deficit (EFD)			
	Control Groups		Clinical Groups	
OPTIMIZATION	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an EFD			
Monitors school task performance	16%	54%	46%	44%*
Monitors school situations	15%	44%	46%	41%*
Activity level fits school tasks	18%	25%	21%	42%*+
Emotional response fits school tasks	27%	23%	27%	47%*
Fixes errors in school tasks	36%	48%	58%	62%*
Balances school task elements	24%	50%	40%	60%*
Self/Social Arena				
Monitors social interactions	17%	29%	35%	43%*
Monitors personal appearance	19%	13%	23%	46%*+
Activity level fits social situation	39%	21%	29%	55%*+
Emotional response fits social interactions	27%	17%	33%	50%*
Modulates sensory stimulation	18%	17%	27%	33%*
Makes social interaction corrections	21%	25%	33%	39%*
Balances social interactions	22%	29%	48%	47%*
Balances personal activity, care, habits	24%	31%	48%	51%*

	Executive Skill Deficit (ESD)			
	Control Groups		Clinical Groups	
OPTIMIZATION	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an ESD			
Monitors school task performance	0%	6%	38%*	19%*
Monitors school situations	1%	6%	15%	11%*
Activity level fits school tasks	0%	0%	6%	15%*
Emotional response fits school tasks	1%	0%	4%	22%*
Fixes errors in school tasks	7%	6%	23%	21%*
Balances school task elements	6%	4%	33%*	21%*

Self/Social Arena				
Monitors social interactions	0%	2%	15%	21%*
Monitors personal appearance	1%	2%	6%	13%*
Activity level fits social situation	6%	0%	8%	33%*+
Emotional response fits social interactions	4%	2%	2%	28%*+
Modulates sensory stimulation	3%	0%	6%	10%
Makes social interaction corrections	2%	0%	10%	16%*
Balances social interactions	1%	2%	6%	15%*
Balances personal activity, care, habits	2%	2%	8%	17%*

*Note.*Clinical Group % Significantly Greater than Control Group %.

ADHD group vs control group.

As predicted, the ADHD group had significantly larger proportions of students than the matched control group that were rated as having an EFD within the Academic Arena for all 6 of the items assessing the Optimization Cluster self-regulation capacities of Monitor (2 of 2), Modulate (2 of 2), Correct and Balance. The ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an ESD within the Academic Arena for all 6 of the items assessing the Optimization Cluster self-regulation capacities Monitor (2 of 2), Modulate (2 of 2), Correct and Balance.

In addition however, the ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an EFD within the Self/Social Arena for all 8 of the items assessing the Optimization Cluster self-regulation capacities of Monitor (2 of 2), Modulate (3 of 3), Correct and Balance (2 of 2). Similarly, the ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an ESD for 7 of the 8 items within the Self/Social Arena assessing the Optimization Cluster self-regulation capacities of Monitor (2 of 2), Modulate (2 of 3), Correct and Balance (2 of 2).

LD group vs control group.

No significant differences were found between the ratings of the LD group and the control group in the number of EFD ratings for any of the 6 items within the Academic Arena of the Optimization Cluster. The LD group did have significantly larger proportions of ratings indicating an ESD than the students in the matched control group for 2 items within the Academic Arena assessing the Optimization Cluster self-regulation capacities of Monitor (1 of 2) and Balance. No significant differences were found between the ratings of the LD group and the control group in the number of EFD or ESD ratings for any of the 8 items within the Self/Social Arena.

ADHD group vs LD group.

When comparing teacher ratings of the ADHD group and the LD group, the ADHD group had a significantly greater percentage of EFD ratings than the LD group for only one of the 6 items assessing the Academic Arena self-regulation capacity of Modulate (1 of 3). Additionally, within the Self/Social Arena the ADHD group had a significantly greater percentage of ratings indicating an EFD than the LD group for two items assessing the self-regulation capacities of Monitor (1 of 2) and Modulate (1 of 3). A significant difference was found between the ratings of the ADHD group and the LD group in the number of ESD ratings for 2 of the 8 items within the Self/Social Arena assessing the self-regulation capacity of Modulate (2 of 3). No significant differences were found between the ratings of the ADHD group and the LD group in the number of ESD ratings for any of the 6 items within the Academic Arena. In contrast to predictions however, the ADHD group had a significantly greater percentage of ratings indicating an ESD than the LD group for two items assessing the

self-regulation capacities of Modulate (2 of 3). Although these findings within the Academic Arena are consistent with the initial hypothesis regarding the Modulate capacity, the number of significant differences between the ADHD and LD groups was far fewer than anticipated. Additionally, the significant differences between the groups found for some items within the Self/Social Arena were not anticipated.

Efficiency Cluster Results

Within the Efficiency Cluster, 10 items are included in the Academic Arena and 4 items are included in the Self/Social Arena. Table 4.10 shows a summary of the significant differences that were identified when comparing proportions of students who were rated by teachers as exhibiting EFDs or ESDs on the items of the Optimization Cluster. Proportion comparisons were made between the clinical groups and their respective matched control samples and between the two clinical samples. The results of the statistical analyses completed for each Optimization Cluster item are provided in Appendix B.

Table 4.10

Summary of the Significant Differences in Teacher Ratings of EFDs and ESDs When Comparing ADHD-Diagnosed and LD-Classified Groups With Matched Controls and When Comparing the ADHD-Diagnosed Group With the LD-lassified group on the MEFS Efficiency Cluster items.

Type of Deficit	Group Comparisons							
	ADHD>Controls		LD>Controls		ADHD>LD		LD>ADHD	
	Number of Efficiency Cluster Items by Arena							
	ACA 10 Items	S/S 4 Items	ACA 10 Items	S/S 4 Items	ACA 10 Items	S/S 4 Items	ACA 10 Items	S/S 4 Items
	Number of Items Showing Significant Differences							
EFD	6 (60%)	2 (50%)	0 (0%)	3 (75%)	0 (0%)	0 (0%)	0 (0%)	1 (10%)
ESD	9 (90%)	2 (50%)	3 (30%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 4.11 shows the items of the Efficiency Cluster and the percentages of students in each group that were rated as having an EFD or an ESD.

Table 4.11

Percentages of EFD and ESD Teacher Ratings for the Clinical and Control Groups on the MEFS Efficiency Cluster Items

	Executive Function Deficit (EFD)			
	Control Groups		Clinical Groups	
EFFICIENCY	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an EFD			
Keeps track of time with school tasks	39%	48%	52%	47%
Changes pace with school tasks	40%	50%	52%	48%
Uses routines for school tasks	24%	35%	50%	39%*
Gets ideas onto paper effectively	40%	50%	50%	53%
Uses routines and strategies on tests	31%	50%	48%	50%*
Uses routines and strategies with school tasks	31%	35%	52%	50%*
Participates in class discussions	19%	25%	35%	23%
Brings materials home from school	23%	33%	44%	52%*
Hands in school work	19%	29%	40%	43%*
Gets the steps in the correct order for school tasks	21%	38%	58%	42%*
Self/Social Arena				
Keeps track of time in social interactions	40%	38%	48%	51%
Changes pace in social interactions	29%	25%	65%*	50%*
Uses routines for social interactions	18%	17%	40%*	28%
Gets the right order when telling stories	16%	21%	60%*+	37%*

	Executive Skill Deficit (ESD)			
	Control Groups		Clinical Groups	
EFFICIENCY	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an ESD			
Keeps track of time with school tasks	2%	4%	23%	27%*
Changes pace with school tasks	5%	6%	21%	20%*
Uses routines for school tasks	0%	2%	12%	11%*
Gets ideas onto paper effectively	4%	4%	35%*	20%*
Uses routines and strategies on tests	4%	6%	31%*	19%*

Uses routines and strategies with school tasks	5%	6%	27%*	22%*
Participates in class discussions	1%	2%	10%	4%
Brings materials home from school	5%	10%	21%	19%*
Hands in school work	6%	8%	19%	22%*
Gets the steps in the correct order for school tasks	1%	2%	19%	16%*
Self/Social Arena				
Keeps track of time in social interactions	1%	4%	21%	21%*
Changes pace in social interactions	2%	4%	8%	14%*
Uses routines for social interactions	1%	0%	4%	8%
Gets the right order when telling stories	0%	2%	13%	8%

Note. Clinical Group % Significantly Greater than Control Group %.
Note. Clinical Group % Significantly Greater than Control Group and the other Clinical Group %.

ADHD group vs control group.

The ADHD group had significantly larger proportions of students than the matched control group that were rated as having an EFD within the Academic Arena for 6 of the 10 items assessing the Efficiency Cluster self-regulation capacities of Pace, Use Routines (5 of 7), and Sequence. The ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an ESD within the Academic Arena for 9 of the 10 items assessing the Efficiency Cluster self-regulation capacities of Sense Time, Pace, Use Routines (6 of 7) and Sequence.

Additionally, the ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an EFD within the Self/Social Arena for 2 of the 4 items assessing the Efficiency Cluster self-regulation capacities of Pace and Sequence. Similarly, the ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an ESD within the Self/Social Arena for 2 of the 4 items assessing the Efficiency Cluster self-regulation capacities of Sense Time and Pace.

LD group vs control group.

No significant differences were found between the LD group and the control group in the number of students rated as having an EFD for any of the 10 items within the Academic Arena of the Efficiency Cluster. The LD group did have a significantly greater percentage of ESD ratings than the students in the matched control group for 3 items within Academic Arena that assess the self-regulation capacity of Use Routines (3 of 7). Within the Self/Social Arena, the LD group had significantly greater percentages of EFD ratings than the students in the control group for 3 item assessing the self-regulation capacities of Pace, Use Routines, and Sequence. No significant differences were found between the ratings of the LD group and the control group in the number of ESD ratings for the 4 Efficiency Cluster items within the Self/Social Arena. Although the ESD deficits within the Academic Arena are consistent with initial hypotheses, the EFD deficits within the Self/Social Arena are not.

ADHD group vs LD group.

When comparing teacher ratings of the ADHD group and the LD group, the LD group had a significantly greater percentage of EFD ratings than the students in the ADHD group only for one of the 4 items within the Self/Social Arena that assess the self-regulation capacity of Sequence.

Memory Cluster Results

Within the Memory Cluster, 3 items are included in the Academic Arena and 4 items are included in the Self/Social Arena. Table 4.12 shows a summary of the significant differences that were identified when comparing proportions of students who were rated by teachers as exhibiting EFDs or ESDs on the items of the Memory Cluster. Proportion comparisons were made between the clinical groups and their respective matched control samples and between the

two clinical samples. The results of the statistical analyses completed for each Memory Cluster item are provided in Appendix B.

Table 4.12

Summary of the Significant Differences in Teacher Ratings of EFDs and ESDs When Comparing ADHD-Diagnosed and LD-Classified Groups With Matched Controls and When Comparing the ADHD-Diagnosed Group With the LD-Classified Group on the MEFS Memory Cluster Items.

Type of Deficit	Group Comparisons							
	ADHD>Controls		LD>Controls		ADHD>LD		LD>ADHD	
	Number of Memory Cluster Items by Arena							
	ACA	S/S	ACA	S/S	ACA	S/S	ACA	S/S
	3 Items	4 Items	3 Items	4 Items	3 Items	4 Items	3 Items	4 Items
	Number of Items Showing Significant Differences							
EFD	3 (100%)	4 (100%)	0	2 (50%)	0	0	0	1 (25%)
ESD	3 (100%)	0	1 (33%)	0	0	0	1 (33%)	0

Table 4.13 shows the items of the Memory Cluster and the percentages of students in each group that were rated as having an EFD or an ESD.

Table 4.13

Percentages of EFD and ESD teacher ratings for the clinical and control groups on the MEFS Memory Cluster items

	Executive Function Deficit (EFD)			
	Control Groups		Clinical Groups	
MEMORY	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an EFD			
Keeps information in mind for school tasks	19%	29%	50%	43%*
Stores and recalls school information	26%	42%	65%	46%*
Recalls information for tests	29%	42%	54%	53%*
Self/Social Arena				
Keeps information in mind in social interactions	14%	19%	40%	27%*
Stores and retrieves social information	16%	17%	58%*+	36%*

Recalls information in social interactions	17%	25%	56%*	42%*
Recalls information about self	11%	19%	29%	27%*

	Executive Skill Deficit (ESD)			
	Control Groups		Clinical Groups	
MEMORY	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an ESD			
Keeps information in mind for school tasks	2%	6%	25%	15%*
Stores and recall school information	2%	8%	27%	16%*
Recalls information for tests	3%	6%	38%*+	14%*
Self/Social Arena				
Keeps information in mind in social interactions	1%	2%	6%	10%
Stores and retrieves social information	1%	4%	10%	7%
Recalls information in social interactions	0%	2%	10%	8%
Recalls information about self	1%	2%	6%	5%

Note. Clinical Group % Significantly Greater than Control Group %.

ADHD group vs control group.

The ADHD group had significantly larger proportions of students than the matched control group that were rated as having an EFD within the Academic Arena for all 3 of the items assessing the Memory Cluster self-regulation capacities of Hold/Manipulate and Store/Retrieve (2 of 2). The ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an ESD within the Academic Arena all 3 of the items assessing the Memory Cluster self-regulation capacities of Hold/Manipulate and Store/Retrieve (2 of 2).

In addition however, the ADHD group also had significantly larger proportions of students than the matched control group that were rated as having an EFD within the Self/Social Arena for all 4 items assessing the Memory Cluster self-regulation capacities. No significant

differences in the number of ESD ratings were found between the ADHD group and the control group for any of the 4 items within the Self/Social Arena.

LD group vs control group.

No significant differences in the number of EFD ratings were found between the LD group and the control group for any of the 3 Memory Cluster items within the Academic Arena. The LD group had a significantly greater percentage of ESD ratings than the control group within the Academic Arena for only one item assessing the self-regulation capacity of Store/Retrieve (1 out of 2). Within the Self/Social Arena the LD group had significantly greater percentages of EFD ratings than the control group for 2 items assessing the self-regulation capacity of Store/Retrieve (2 of 3). No significant differences were found between the ESD ratings of the LD group and the control group for any of the 4 items within the Self/Social Arena. The Memory Cluster deficits identified within the Academic Arena were consistent with the initial hypotheses, but the Deficits identified within the Self/Social Arena were not consistent with the initial hypotheses.

ADHD group vs LD group.

The LD group had a significantly greater percentage of ESD ratings than the ADHD group within the Academic Arena for one Memory Cluster item that assesses the self-regulation capacity of Store/Retrieve (1 of 2). The LD group also had a significantly greater percentage of EFD ratings within the Self/Social Arena for one Memory Cluster item that assesses the self-regulation capacity of Store/Retrieve (1 of 3).

Inquiry Cluster Results

Within the Inquiry Cluster, 5 items are included in the Academic Arena and 6 items are included in the Self/Social Arena. Table 4.14 shows a summary of the significant differences

that were identified when comparing proportions of students who were rated by teachers as exhibiting EFDs or ESDs on the items of the Inquiry Cluster. Proportion comparisons were made between the clinical groups and their respective matched control samples and between the two clinical samples. The results of the statistical analyses completed for each Inquiry Cluster item are provided in Appendix B.

Table 4.14

Summary of the Significant Differences in Teacher Ratings of EFDs and ESDs When Comparing ADHD-Diagnosed and LD-Classified Groups With Matched Controls and When Comparing the ADHD-Diagnosed Group With the LD-Classified Group on the MEFS Inquiry Cluster Items.

Type of Deficit	Group Comparisons							
	ADHD>Controls		LD>Controls		ADHD>LD		LD>ADHD	
	Number of Inquiry Cluster Items by Arena							
	ACA	S/S	ACA	S/S	ACA	S/S	ACA	S/S
	5 Items	6 Items	5 Items	6 Items	5 Items	6 Items	5 Items	6 Items
	Number of Items Showing Significant Differences							
EFD	4 (80%)	6 (100%)	0	1 (17%)	0	0	0	0
ESD	5 (100%)	6 (100%)	4 (80%)	0	0	0	0	0

Table 4.15 shows the items of the Inquiry Cluster and the percentages of students in each group that were rated as having an EFD or an ESD.

Table 4.15

Percentages of EFD and ESD Teacher Ratings for the Clinical and Control Groups on the MEFS Inquiry Cluster Items

	Executive Function Deficit (EFD)			
	Control Groups		Clinical Groups	
INQUIRY	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an EFD			
Accurately estimates difficulty/demands of school tasks	31%	44%	59%	51%*

Anticipates events at school	38%	35%	46%	50%
Estimates time for school tasks	34%	50%	56%	55%*
Examines and analyzes school tasks	38%	48%	46%	54%*
Evaluates the quality of school work	42%	50%	50%	58%*
Self/Social Arena				
Figures out how to interact in social situations.	16%	19%	33%	48%*
Anticipates effects of own actions	25%	27%	48%	44%*
Anticipates the consequences of own actions	16%	27%	38%	50%*
Estimates time in social situations	27%	25%	44%	57%*
Examines and analyzes social interactions	31%	29%	54%*	52%*
Evaluates the quality of social interactions	26%	38%	44%	51%*

Executive Skill Deficit (ESD)

	Control Groups		Clinical Groups	
INQUIRY	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an ESD			
Accurately estimates difficulty/demands of school tasks	4%	2%	27%*	25%*
Anticipates events at school	4%	4%	29%*	23%*
Estimates time for school tasks	4%	8%	25%	26%*
Examines and analyzes school tasks	5%	8%	35%*	27%*
Evaluates the quality of school work	6%	6%	33%*	29%*
Self/Social Arena				
Figures out how to interact in social situations.	0%	0%	13%	13%*
Anticipates affects of own actions	1%	0%	13%	19%*
Anticipates the consequences of own actions	3%	2%	15%	19%*
Estimates time in social situations	3%	6%	19%	17%*
Examines and analyzes social interactions	1%	2%	13%	16%*
Evaluates the quality of social interactions	6%	2%	21%	19%*

Note: Clinical Group % Significantly Greater than Control Group %.

ADHD group vs control group.

The ADHD group had significantly larger proportions of EFD ratings than the control group within the Academic Arena for 4 of the 5 items of the Inquiry Cluster that assess the self-regulation capacities of Gauge, Estimate Time, Analyze and Compare. The ADHD group also had significantly larger proportions of ESD ratings than the control group within the Academic Arena for all 5 of the items of the Inquiry Cluster that assess the self-regulation capacities of Gauge, Anticipate, Estimate Time, Analyze and Compare.

In addition however, the ADHD group also had significantly larger proportions of EFD and ESD ratings than the control group within the Self/Social Arena for all 6 items of the Inquiry Cluster that assess the self-regulation capacities of Gauge, Anticipate (2 of 2), Estimate Time, Analyze and Compare.

LD group vs control group.

No significant differences were found between the EFD ratings of the LD group and the EFD ratings of the control group for any of the items within the Academic Arena. In contrast, the LD group had significantly greater percentages of ESD ratings than the control group within the Academic Arena for 4 of the 5 items of the Inquiry Cluster that assess the self-regulation capacities of Gauge, Estimate Time, Analyze and Compare. Within the Self/Social Arena the LD group had a significantly greater percentage of EFD ratings than the control group for only one item assessing the self-regulation capacity of Analyze. Similarly, no significant differences were found between ESD ratings of the LD group and the control group for any of the Inquiry Cluster items within the Self/Social Arena.

ADHD group vs LD group.

No significant differences were found between the EFD or ESD ratings of the ADHD group and the LD group for any of the Inquiry Cluster items within either the Academic or Self/Social Arenas.

Solution Cluster Results

Within the Solution Cluster, 6 items are included in the Academic Arena and 7 items are included in the Self/Social Arena. Table 4.16 shows a summary of the significant differences that were identified when comparing proportions of students who were rated by teachers as exhibiting EFDs or ESDs on the items of the Solution Cluster. Proportion comparisons were made between the clinical groups and their respective matched control samples and between the two clinical samples. The results of the statistical analyses completed for each Solution Cluster item are provided in Appendix B.

Table 4.16

Summary of the Significant Differences in Teacher Ratings of EFDs and ESDs When Comparing ADHD-Diagnosed and LD-Classified Groups With Matched Controls and When Comparing the ADHD-Diagnosed Group With the LD-Classified Group on the MEFS Solution Cluster Items.

Type of Deficit	Group Comparisons							
	ADHD>Controls		LD>Controls		ADHD>LD		LD>ADHD	
	Number of Solution Cluster Items by Arena							
	ACA	S/S	ACA	S/S	ACA	S/S	ACA	S/S
	6 Items	7 Items	6 Items	7 Items	6 Items	7 Items	6 Items	7 Items
	Number of Items Showing Significant Differences							
EFD	4 (67%)	4 (57%)	0	0	0	0	0	0
ESD	6 (100%)	7 (100%)	5 (83%)	0	0	0	0	0

Table 4.17 shows the items of the Inquiry Cluster and the percentages of students in each group that were rated as having an EFD or an ESD.

Table 4.17

Percentages of EFD and ESD Teacher Ratings for the Clinical and Control Groups on the MEFS Solution Cluster Items

	Executive Function Deficit (EFD)			
	Control Groups		Clinical Groups	
SOLUTION	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an EFD			
Comes up with new ways to solve school tasks	38%	56%	54%	58%*
Sees similarities in ideas	31%	44%	56%	52%*
Organizes school tasks	32%	58%	46%	55%*
Makes plans for school tasks	40%	56%	44%	55%*
Orders school tasks	40%	65%	48%	52%
Makes own decisions about school	28%	42%	48%	42%
Self/Social Arena				
Comes up with new ways to solve social issues	29%	38%	54%	52%*
Sees similarities in social interactions	32%	31%	50%	48%*
Organizes social activities	21%	25%	48%	36%*
Makes plans for social activities	26%	23%	44%	40%
Makes plans for the use of own time	34%	31%	46%	44%
Prioritizes social activities	26%	31%	46%	47%*
Makes own decisions about social situations	22%	23%	31%	35%

	Executive Skill Deficit (ESD)			
	Control Groups		Clinical Groups	
SOLUTION	ADHD	LD	LD	ADHD
Academic Arena	% of Group Rated as Having an ESD			
Comes up with new ways to solve school tasks	5%	4%	33%*	22%*
Sees similarities in ideas	2%	4%	29%*	17%*
Organizes school tasks	7%	6%	33%*	29%*
Makes plans for school tasks	3%	4%	31%*	29%*
Orders school tasks	5%	4%	35%*	31%*
Makes own decisions about school	2%	4%	21%	22%*
Self/Social Arena				

Comes up with new ways to solve social issues	1%	2%	15%	15%*
Sees similarities in social interactions	2%	2%	21%	16%*
Organizes social activities	2%	2%	17%	22%*
Makes plans for social activities	1%	4%	19%	15%*
Makes plans for the use of own time	1%	4%	19%	17%*
Prioritizes social activities	2%	2%	21%	16%*
Makes own decisions about social situations	1%	2%	14%	12%*

Note: Clinical Group % Significantly Greater than Control Group %.

ADHD group vs control group.

The ADHD group had significantly larger proportions of EFD ratings than the control group within the Academic Arena for 4 of the 6 items of the Solution Cluster that assess the self-regulation capacities of Generate, Associate, Organize and Plan. The ADHD group also had significantly larger proportions of ESD ratings than the control group within the Academic Arena for all 6 of the items of the Solution Cluster that assess the self-regulation capacities of Generate, Associate, Organize, Plan, Prioritize and Decide.

In addition however, the ADHD group had significantly larger proportions of EFD and ratings than the control group within the Self/Social Arena for all 7 items of the Solution Cluster that assess the self-regulation capacities of Generate, Associate, Organize, Plan (2 of 2), Prioritize and Decide. Similarly, the ADHD group also had significantly larger proportions of ESD and ratings than the control group within the Self/Social Arena for all 7 items of the Solution Cluster that assess the self-regulation capacities of Generate, Associate, Organize, Plan (2 of 2), Prioritize and Decide.

LD group vs control group.

No significant differences were found between the EFD ratings of the LD group and the EFD ratings of the control group for any of the Solution Cluster items within the Academic

Arena. In contrast, the LD group had significantly greater percentages of ESD ratings than the control group within the Academic Arena for 5 of the 6 items of the Solution Cluster that assess the self-regulation capacities of Generate, Associate, Organize, Plan, Prioritize and Decide. Within the Self/Social Arena no significant differences were found between EFD or ESD ratings of the LD group and the control group for any of the Solution Cluster items within the Self/Social Arena.

ADHD group vs LD group.

No significant differences were found between the EFD or ESD ratings of the ADHD group and the LD group for any of the Solution Cluster items within either the Academic or Self/Social Arenas.

Summary of Self-Regulation Executive Capacity Cluster Results

Table 4.18 shows a summary of the total number of significant differences found when comparing teacher ratings of students in the clinical groups with matched control samples and when comparing the clinical samples with each other. Table 4.18 shows the number of statistically significant differences in the proportions of EFDs and ESDs found within each Self-Regulation Cluster as well as the total number of the statistically significant differences among the groups for ratings reflecting EFDs and ESDs on all of the items included on the 7 MEFS Self-Regulation Clusters.

Table 4.18

Summary of the Significant Differences in Teacher Ratings of EFDs and ESDs for the Clinical and Matched Control Groups on the 7 MEFS Self-Regulation Clusters.

	Group Comparisons of Number of Items Rated as EFD							
	ADHD > Controls		LD > Controls		ADHD > LD		LD > ADHD	
	Number of Significant Differences in EFDs by Arena							
Cluster	ACA	S/S	ACA	S/S	ACA	S/S	ACA	S/S

Attention	3 (100%)	3 (100%)	0	0	0	0	0	0
Engagement	8 (100%)	10 (71%)	1 (13%)	1 (7%)	2 (25%)	0	0	0
Optimization	6 (100%)	8 (100%)	0	0	1 (17%)	2 (25%)	0	0
Efficiency	6 (60%)	2 (50%)	0	3 (75%)	0	0	0	1 (25%)
Memory	3 (100%)	4 (100%)	0	2 (50%)	0	0	0	1 (25%)
Inquiry	4 (80%)	6 (100%)	0	1 (17%)	0	0	0	0
Solution	4 (67%)	4 (57%)	0	0	0	0	0	0
Total	34 (83%)	37 (80%)	1 (2%)	7 (15%)	3 (7%)	4 (9%)	0	2 (5%)
	Group Comparisons of Number of Items Rated as ESD							
	ADHD > Controls		LD > Controls		ADHD > LD		LD > ADHD	
	Number of Significant Differences in ESDs by Arena							
Cluster	ACA	S/S	ACA	S/S	ACA	S/S	ACA	S/S
Attention	3 (100%)	0	0	0	0	0	0	0
Engagement	6 (75%)	7 (50%)	0	0	0	0	0	0
Optimization	6 (100%)	7 (88%)	2 (33%)	0	0	2 (25%)	0	0
Efficiency	9 (90%)	2 (50%)	3 (30%)	0	0	0	0	0
Memory	3 (100%)	0	1 (33%)	0	0	1 (33%)	0	0
Inquiry	5 (100%)	6 (100%)	4 (80%)	0	0	0	0	0
Solution	6 (100%)	7 (100%)	5 (83%)	0	0	0	0	0
Total	38 (93%)	29 (63%)	15 (37%)	0	0 (0%)	3 (7%)	0	0

As shown in Table 4.18, significantly larger proportions of students in the ADHD group than the control group were rated as having an EFD across the 7 clusters for 34 of the 41 items (83%) within the Academic Arena and 37 of 46 items (80%) within the Self/Social Arena.

In contrast, the LD clinical group analyses indicate significantly larger proportions of students than the control group were rated as having an EFD for only 1 of the 41 items (2%) within the Academic Arena and for 7 of the 46 items (14%) within the Self/Social Arena.

Additionally, when comparing the clinical groups, significantly larger proportions of students in the ADHD group than the LD group were rated as having an EFD for 3 of the 41 items (7%) within the Academic Arena and for 4 of the 46 items (9%) within the Self/Social Arena. There were no significantly larger proportions of students in the LD group than the ADHD group rated as having an EFD for any of the 41 items (0%) within the Academic Arena of the 46 items (0%) within the Self/Social Arena.

In the case of ESDs, a review of the total numbers indicated significantly larger proportions of students in the ADHD group than in the matched control group were rated as having an ESD for 38 of the 41 items (91%) within the Academic Arena and 29 of the 46 items (63%) within the Self/Social Arena. Comparatively, a significantly larger proportion of students in the LD group than students in their matched control group were rated as having an ESD for 15 of the 41 items (37%) within the Academic Arena and none of the 46 (0%) items within the Self/Social Arena. When comparing the clinical groups, significantly larger proportions of students in the ADHD group than the LD group were rated as having an ESD for 1 of the 41 items (2%) within the Academic Arena and for 2 of the 46 items (4%) within the Self/Social Arena. There were no significantly larger proportions of students in the LD group than the ADHD group rated as having an ESD for none of the 41 items (0%) within the Academic Arena and for none of the 46 items (0%) within the Self/Social Arena.

Self-Realization Cluster

Table 4.19 shows a summary of the significant differences found when comparing students in the clinical groups with matched control samples and when comparing the ADHD and LD diagnosed clinical samples who were rated by teachers as exhibiting a delayed development in the areas assessed by the Self-Realization Cluster.

Table 4.19

Summary of the Significant Differences in Teacher Ratings of Students Exhibiting Delayed Development When Comparing ADHD-Diagnosed and LD-Classified Groups With Matched Controls and When Comparing the ADHD-Diagnosed Group With the LD-Classified Group on the MEFS Self-Realization Cluster Items.

Dev. Delays	Group Comparisons			
	ADHD>Controls	LD>Controls	ADHD>LD	LD>ADHD
	Number of Self-Realization Cluster Items			
	11 Items	11 Items	11 Items	11 Items
	Number of Items Showing Significant Differences			
Delays	0	0	0	0

As shown in Table 4.19, results of teacher ratings of students in the ADHD and LD groups and their nonclinical peers did not indicate statistically significant findings on any items within the Self-Realization Cluster. Additionally, no statistically significant differences were found between teacher ratings of the ADHD group and the LD group on any items within the Self-Realization Cluster.

Self-Determination Cluster

Table 4.20 shows a summary of the significant differences found when comparing students in the clinical groups with matched control samples and when comparing the ADHD and LD-diagnosed clinical samples who were rated by teachers as exhibiting delayed development in the areas assessed by the Self-Determination Cluster.

Table 4.20

Summary of the Significant Differences in Teacher Ratings of Students Exhibiting Delayed DevelopmentWhen Comparing ADHD-Diagnosed and LD-Classified Groups With Matched Controls and When Comparing the ADHD-Diagnosed Group With the LD-Classified Group on the MEFS Self-Determination Cluster Items.

	Group Comparisons			
	ADHD>Controls	LD>Controls	ADHD>LD	LD>ADHD
	Number of Self-Determination Cluster Items			
Dev.	6 Items	6 Items	6 Items	6 Items
Delays	Number of Items Showing Significant Differences			
Delays	2	0	0	0

As shown in Table 4.20, results of teacher ratings of students in the ADHD group indicate a significantly larger percentage of having a delay within two out of the six items within the Self-Determination cluster in comparison to their nonclinical peers. The LD group in comparison to their nonclinical peers did not indicate statistically significant findings on any test items within the Self-Determination Cluster. Additionally, no statistically significant differences were found between teacher ratings of the ADHD group and the LD group on any test items within the Self-Determination Cluster.

CHAPTER 5

DISCUSSION

This study compared the pattern of executive function deficits (EFDs) and executive skill deficits (ESDs) resulting from teacher ratings of groups of students diagnosed with ADHD and students diagnosed with LD and teacher ratings of demographically-matched control groups of students with no clinical diagnosis. Analyses examined teacher responses to all of the items of the 7 Self-Regulation Clusters and all of the items of the Self-Realization and Self-Determination Clusters of the MEFS. Furthermore, the study examined teacher ratings to determine if more deficits were noted for items within the Academic Arena than for items within the Self/Social Arena in each of the Self-Regulation Clusters when comparing the clinical groups to their matched controls and when comparing the ADHD group with the LD group.

Summary of Findings

ADHD vs Control Group

EFDs within the academic arena.

Consistent with the initial hypotheses, statistically significant differences were found between the proportion of EFD ratings of the ADHD group and the matched control group for all, or most, of the items within the Academic Arena in each of the 7 Self-Regulation Clusters. Statistically significant differences between the proportions of EFD ratings for the ADHD and control groups were found for every item of the Attention, Engagement, Optimization and Memory Clusters. For the remaining three clusters, statistically significant differences were found for 90% of the items in the Efficiency Cluster, 80% in the Inquiry Cluster and 67% in the Solution Cluster. Even in cases where statistically significant differences were not found, the percentage of EFD ratings for the ADHD group always exceeded the percentage of EFD ratings

of the control group. Across all 7 Self-Regulation Clusters, 83% of the items within the Academic Arena produced statistically significant differences between the proportions of EFD ratings of the ADHD group and the control group.

EFD's within the self/social arena.

Consistent with the initial hypotheses, statistically significant differences were found between the proportion of EFD ratings of the ADHD group and the matched control group for many of the items within the Self/Social Arena in each of the 7 Self-Regulation Clusters. Statistically significant differences between the proportions of EFD ratings for the ADHD and control groups were found for every item of the Attention, Optimization, Memory and Inquiry Clusters. For the remaining three clusters, statistically significant differences were found for 71% of the items in the Engagement Cluster, 57% in the Solution Cluster and 50% in the Efficiency Cluster. Even in cases where statistically significant differences were not found, the percentage of EFD ratings for the ADHD group always exceeded the percentage of EFD ratings of the control group. Across all 7 Self-Regulation Clusters, 80% of the items within the Self/Social Arena produced statistically significant differences between the proportions of EFD ratings of the ADHD group and the control group.

Academic arena vs self/social arena EFDs.

Consistent with the initial hypotheses, the proportion of statistically significant differences found between the ADHD group and the control group was greater for EFD ratings of items within the Academic Arena than for items within the Self/Social Arena. Specifically, more Academic Arena items than Self/Social Arena items reflected statistically significant differences between the ADHD and control group EFD rating proportions for the Engagement (100% vs 71%), Efficiency (90% vs 50%), and Solution (67% vs 50%) Clusters. No differences

in these proportions were evident in the Attention, Optimization and Memory Clusters. The only exception to the hypothesized results occurred in the case of the items of the Inquiry Cluster, wherein a greater proportion of items within the Self/Social Arena were identified as EFD ratings than in the Academic Arena (100% vs 80%). Across all 7 Self-Regulation Clusters, the number of statistically significant differences was greater within the Academic Arena (34 of 41 items; 83%) than the Self/Social Arena (37 of 46 items; 80%).

ESDs within the academic arena.

Consistent with the initial hypotheses, statistically significant differences were found between the proportion of ESD ratings of the ADHD group and the matched control group for all, or most, of the items within the Academic Arena in each of the 7 Self-Regulation Clusters. Statistically significant differences between the proportions of ESD ratings for the ADHD and control groups were found for every item of the Attention, Optimization, Memory, Inquiry and Solution Clusters. For the remaining two clusters, statistically significant differences were found for 90% of the items in the Efficiency Cluster and 75% in the Engagement Cluster. Even in cases where statistically significant differences were not found, the percentage of ESD ratings for the ADHD group always exceeded the percentage of ESD ratings of the control group. Across all 7 Self-Regulation Clusters, 93% of the items within the Academic Arena produced statistically significant differences between the proportions of ESD ratings of the ADHD group and the control group.

ESD's within the self/social arena.

Consistent with the initial hypotheses, statistically significant differences were found between the proportion of ESD ratings of the ADHD group and the matched control group for many of the items within the Self/Social Arena in 5 of the 7 Self-Regulation Clusters.

Statistically significant differences between the proportions of ESD ratings for the ADHD and control groups were found for every item of the Inquiry and Solution Clusters. Statistically significant differences also were found for 88% of the items in the Optimization Cluster, 50% in the Engagement Cluster and 50% in the Efficiency Cluster.

Exceptions to the initial hypotheses were found in the cases of the Attention and Memory Clusters in that no statistically significant differences were found for any of the items with the Self/Social Arena. Even in cases where statistically significant differences were not found however, the percentage of ESD ratings for the ADHD group always exceeded the percentage of ESD ratings of the control group. Across all 7 Self-Regulation Clusters, 63% of the items within the Self/Social Arena produced statistically significant differences between the proportions of ESD ratings of the ADHD group and the control group.

Academic arena vs self/social arena ESDs.

Consistent with the initial hypotheses, the proportion of statistically significant differences found between the ADHD group and the control group was greater for ESD ratings of items within the Academic Arena than for items within the Self/Social Arena for 5 of the 7 Self-Regulation Clusters. Specifically, more Academic Arena items than Self/Social Arena items reflected statistically significant differences between the ADHD and control group ESD ratings proportions in the cases of the Attention (100% vs 0%), Engagement (75% vs 50%), Optimization (100% vs 88%), Efficiency (90% vs 50%), and Memory (100% vs 0%) Clusters. No differences in these proportions were evident for the Inquiry and Solution Clusters. Across all 7 Self-Regulation Clusters, the number of statistically significant differences was greater within the Academic Arena (38 of 41 items; 93%) than the Self/Social Arena (29 of 46 items; 63%).

Academic arena EFDs vs ESDs.

Statistically significant differences were more frequently found for ESD ratings than for EFD ratings within Academic Arena items for the Efficiency (90% vs 60%), Inquiry (100% vs 80%), and Solution (100% vs 67%) Clusters. Statistically significant differences for ESD ratings were as frequent as EFD ratings for the Attention, Optimization and Memory Clusters; in these instances, all items of the cluster reflected statistically significant differences for both ESDs and EFDs.

Self/social arena EFDs vs ESDs.

In contrast to the findings for items within the Academic Arena, statistically significant differences were more frequently found for EFD ratings of Self/Social Arena items than for ESD ratings for the Attention (100% vs 0%), Engagement (71% vs 50%), Optimization (100% vs 88%), and Memory (100% vs 0%) Clusters. Statistically significant differences for EFD ratings were as frequent as ESD ratings for the Efficiency (50% vs 50%) and Inquiry (100% vs 100%) Clusters. More consistent with the Academic Arena findings, statistically significant differences were more frequently found for ESD ratings of Self/Social Arena items than for EFD ratings for the Solution Cluster (100% vs 57%).

LD vs Control Group

EFDs within the Academic Arena. Statistically significant differences were found between the proportion of EFD ratings of the LD group and the matched control group for only 1 item within the Academic Arena of the Engagement Cluster. No statistically significant differences between the proportions of EFD ratings for the LD and control groups were found for any of the items of the Attention, Optimization, Efficiency, Memory, Inquiry, and Solution Clusters. This finding is not consistent with the initial hypothesis that statistically significant

differences would be found between the proportion of EFD ratings of the LD group and the matched control group for items within the Academic Arena.

EFD's within the self/social arena.

In contrast to the findings for items within the Academic Arena, statistically significant differences were found between the proportion of EFD ratings of the LD group and the matched control group for some of the items with the Self/Social Arena for the Engagement (7%), Efficiency (75%), Memory (50%), and Inquiry (17%) Clusters. No statistically significant differences between the proportions of EFD ratings for the LD and control groups were found for any of the items of the Attention, Optimization, Efficiency, Memory, and Solution Clusters. This finding is only partially consistent with the initial hypothesis that statistically significant differences would be found between the proportion of EFD ratings of the LD group and the matched control group for items within the Self/Social Arena.

Academic arena vs self/social arena EFDs.

Contrary to the initial hypothesis, the proportion of statistically significant differences found between the LD group and the control group was greater for EFD ratings of items within the Self/Social Arena than for items within the Academic Arena. Specifically, more Self/Social Arena items than Academic Arena items reflected statistically significant differences between the LD and control group EFD rating proportions for the Efficiency (75% vs 0%), Memory (50% vs 0%), and Inquiry (17% vs 0%) Clusters. No differences in these proportions were evident in the Attention, Optimization and Solution Clusters. The only finding consistent with the hypothesized results occurred in the case of the Engagement Cluster, wherein a greater proportion of items within the Academic Arena were identified as EFD ratings than in the Self/Social Arena (13% vs 7%), but it is important to note that the percentages for both arenas

represent only 1 item in each Arena. Across all 7 Self-Regulation Clusters, the number of statistically significant differences was greater within the Self/Social Arena (7 of 41 items; 15%) than the Academic Arena (1 of 46 items; 2%).

ESDs within the academic arena.

Consistent with the initial hypotheses, statistically significant differences were found between the proportion of ESD ratings of the LD group and the matched control group for some of the items within the Academic Arena in 5 of the 7 Self-Regulation Clusters. Statistically significant differences between the proportions of ESD ratings for the LD and control groups were found for items of the Optimization (33%), Efficiency (30%), Memory (33%), Inquiry (80%) and Solution (83%) Clusters. No statistically significant differences were found for the items in the Attention and Engagement Clusters. Across all 7 Self-Regulation Clusters, 37% of the items within the Academic Arena produced statistically significant differences between the proportions of ESD ratings of the LD group and the control group.

ESD's within the self/social arena.

No statistically significant differences were found between the proportion of ESD ratings of the LD group and the matched control group for any of the items within the Self/Social Arena in any of the 7 Self-Regulation Clusters. This finding is not consistent with the initial hypothesis that statistically significant differences would be found between the proportion of ESD ratings of the LD group and the matched control group for items within the Self/Social Arena.

Academic arena vs self/social arena ESDs.

Consistent with the initial hypotheses, the proportion of statistically significant differences found between the LD group and the control group was greater for ESD ratings of items within the Academic Arena than for items within the Self/Social Arena for 5 of the 7 Self-

Regulation Clusters. Specifically, more Academic Arena items than Self/Social Arena items reflected statistically significant differences between the LD and control group ESD ratings proportions for the Optimization (33% vs 0%), Efficiency (30% vs 0%), and Memory (33% vs 0%), Inquiry (80% vs 0%), and Solution (83% vs 0%) Clusters. No differences in these proportions were evident for the Attention (0% vs 0%) and Engagement (0% vs 0%) Clusters. Across all 7 Self-Regulation Clusters, the number of statistically significant differences was greater within the Academic Arena (15 of 41 items; 37%) than the Self/Social Arena (0 of 46 items; 0%).

Academic arena EFDs vs ESDs.

Statistically significant differences were more frequently found for ESD ratings of Academic Arena items than for EFD ratings for the Optimization (33% vs 0%), Efficiency (33% vs 0%), Memory (33% vs 0%), Inquiry (80% vs 0%), and Solution (83% vs 0%) Clusters. Statistically significant differences were more frequently found for EFD ratings of Academic Arena items than for ESD ratings only for the Engagement Cluster (13% vs 0%). Statistically significant differences for ESD ratings were as frequent as EFD ratings only for the Attention Cluster (0% vs 0%).

Self/social arena EFDs vs ESDs.

In contrast to the findings for items within the Academic Arena, statistically significant differences were more frequently found for EFD ratings of Self/Social Arena items than for ESD ratings for the Engagement (7% vs 0%), Efficiency (75% vs 0%), Memory (50% vs 0%), and Inquiry (17% vs 0%) Clusters. Statistically significant differences for EFD ratings were as frequent as ESD ratings for the Attention (0% vs 0%) and Solution (0% vs 0%) Clusters.

ADHD Group vs LD Group

EFDs within the academic arena.

Statistically significant differences between the proportion of EFD ratings of the ADHD group and the LD group within the Academic Arena were found for only 2 items of the Engagement Cluster and one item of the Optimization Cluster. For these three items, the proportions of EFD ratings of the ADHD group were significantly greater than the proportion of EFD ratings of the LD group. No differences between the proportions of EFD ratings of the ADHD group and the LD group were found for any of the items of the Attention, Efficiency, Memory, Inquiry, and Solution Clusters. These findings are consistent with the initial hypothesis that the deficits identified for the ADHD group would be proportionately greater than the deficits identified for the LD group for items within the Engagement Cluster. However, it was anticipated that these significant differences would be found for many more items of the Engagement Cluster and for many of the items of the Attention Cluster. Additionally, these findings are not consistent with the initial hypothesis that the deficits identified for the LD group would be proportionately greater than the deficits identified for the ADHD group for items within the Optimization, Efficiency and Memory Clusters.

EFDs within the self/social arena.

Statistically significant differences between the proportion of EFD ratings of the ADHD group and the LD group within the Self/Social Arena were found for 2 items of the Optimization Cluster. For these two items, the proportions of EFD ratings of the ADHD group were significantly greater than the proportion of EFD ratings of the LD group. Differences also were found for 1 item of the Efficiency Cluster and 1 item of the Memory Cluster. For these two items, the proportions of EFD ratings of the LD group were significantly greater than the

proportion of EFD ratings of the ADHD group. No differences between the proportions of EFD ratings of the ADHD group and the LD group were found for any of the items of the Attention, Inquiry, and Solution Clusters. These findings are consistent with the initial hypothesis that the deficits identified for the LD group would be proportionately greater than the deficits identified for the ADHD group for items within the Efficiency and Memory Cluster. However, it was anticipated that these significant differences would be found for many more items of the Efficiency and Memory Clusters and for many of the items of the Optimization Cluster. Additionally, these findings are not consistent with the initial hypothesis that the deficits identified for the ADHD group would be proportionately greater than the deficits identified for the LD group for items within the Attention and Engagement Clusters.

ESDs within the academic arena.

No statistically significant differences were found between the proportion of ESD ratings of the ADHD group and the LD group within the Academic Arena for any of the items of the 7 Self-Regulation Clusters. These findings are not consistent with the initial hypothesis that the deficits identified for the ADHD group would be proportionately greater than the deficits identified for the LD group for items within the Attention and Engagement Cluster. Additionally, these findings are not consistent with the initial hypothesis that the deficits identified for the LD group would be proportionately greater than the deficits identified for the ADHD group for items within the Optimization, Efficiency and Memory Clusters.

ESDs within the self/social arena.

Statistically significant differences between the proportion of ESD ratings of the ADHD group and the LD group within the Self/Social Arena were found for 2 items of the Optimization Cluster and for one item of the Memory Cluster. For these three items, the proportions of ESD

ratings of the ADHD group were significantly greater than the proportion of ESD ratings of the LD group. No differences between the proportions of ESD ratings of the ADHD group and the LD group were found for any of the items of the Attention, Engagement, Efficiency, Inquiry, and Solution Clusters.

These findings of significant differences are not consistent with the initial hypothesis that the deficits identified for the LD group would be proportionately greater than the deficits identified for the ADHD group for items within the Optimization, Efficiency and Memory Clusters. Additionally, these findings are not consistent with the initial hypothesis that the deficits identified for the ADHD group would be proportionately greater than the deficits identified for the LD group for items within the Attention and Engagement Clusters.

Self-Realization Cluster

With regard to skills assessed within the Self-Realization Cluster, none of the 11 items indicated statistically significant differences between teacher ratings of the clinical ADHD group and their matched controls. Similarly, comparison of the teacher ratings for the LD group and their matched controls yielded no statistically significant differences between groups for all 11 items within the Self-Realization cluster. These findings suggest that although teacher ratings indicated many significant differences in the self-regulation executive capacities of students diagnosed with ADHD and their nonclinical peers and LD-diagnosed students and their nonclinical peers, none of the clinical groups were not rated as having more developmental delays in their levels of awareness of self and others and their capacity for self-analysis than nonclinical peers.

Self-Determination Cluster

With regard to skills assessed within the Self-Determination Cluster, 2 of the 6 items indicated statistically significant differences between teacher ratings of the clinical ADHD group and their matched controls. In comparison, the teacher ratings for the LD-diagnosed group and their matched control groups yielded no statistically significant differences between groups for all 6 items within the Self-Determination cluster. These findings suggest that although teacher ratings indicated many significant differences in the self-regulation executive capacities of students diagnosed with LD in comparison to their nonclinical peers, LD-diagnosed students were not rated as having more developmental delays in their levels of goal setting and long-term planning than nonclinical peers. In comparison, students diagnosed with ADHD in comparison to their nonclinical peers were rated as having more developmental delays in their levels of goal setting and long-term planning.

Implications of the Findings

School aged children with ADHD and LD experience a combination of behavioral, academic, and social challenges. A more comprehensive treatment plan must be created to address the specific executive impairments impacting these individuals in various settings such as home and school. Most researchers and clinicians support multimodal treatment including academic, behavioral, and social-emotional therapy to treat individuals with ADHD and/or LD. Academic and behavior interventions in school help children with ADHD improve academic performance (Barkley, 2018). Targeted academic intervention is required for students' specific subtype of LD as indicated by the psychological processing or academic area of weakness (Feifer, 2011). Although there is general consensus that a combination of treatment is best, there are few systematic evaluations of the efficacy of this approach. A review of the research

regarding treatment options for school-aged children may highlight the need for a more comprehensive treatment plan that targets both academic and social impairments in students with ADHD and LD.

The results of this study are consistent with previous research linking ADHD and LD to deficits with Executive Capacities. The results support the study hypothesis and the current research indicating that clinical groups with ADHD demonstrated a higher degree of executive dysfunction than matched groups of nonclinical peers. Additionally, when considering the combination of function and skill deficits across Academic and Self/Social Arenas, the ADHD group were rated with more deficits than the nonclinical group across most self-regulation clusters. The data supported the hypothesis that the clinical group with ADHD would be rated as having a greater proportion of executive control deficits than matched peers within the Academic Arena. When analyzing ratings for the ADHD group, there were more Self/Social Executive Function deficits found within all self-regulation clusters, except the ADHD-group were rated with more Executive Skill Deficits within the Self/Social Arena on the Inquiry and Solution Clusters. The ADHD-group had a greater proportion of Academic Executive Skill Deficits identified than Executive Function Deficits within the Academic Arena, except for the Engagement Cluster, which rated the ADHD-group with more Executive Function Deficits.

Overall, the ADHD-group were rated with more Executive Function Deficits and Executive Skill Deficits within all areas of self-regulation in comparison to their nonclinical matched control group in the Academic Arena. The ADHD-group were rated with more Executive Function Deficits and Executive Skill Deficits within all the clusters of self-regulation in comparison to their nonclinical matched control group in most areas of the Self/Social Arena; however, students diagnosed with ADHD were not rated with more Executive Skill Deficits

within the Attention and Memory Clusters on the Self/Social Arena in comparison to their nonclinical control group.

Consistent with the hypothesis, a large proportion of deficit ratings for the LD group occurred in comparison to their nonclinical matched peers. A large proportion of Executive Function Deficit ratings for the clinical group with LD occurred within the Engagement Cluster on the Academic Arena and the Engagement Cluster, Efficiency Cluster and Memory Cluster on the Self/Social Arena in comparison to their nonclinical matched peers. The results for the LD group were not clinically significant compared to the matched control group within the EFD Academic Arena of the following clusters: Attention, Optimization, Efficiency, Memory, and Inquiry Clusters. Students in the LD group were rated with more clinically significant ratings on the Academic Executive Skill Deficits in comparison to the matched control group within the following clusters: Optimization, Efficiency, Memory, Inquiry and Solution. The LD group did not have clinically significant ratings on the Self/Social Executive Skill Deficits in comparison to their nonclinical matched control group.

It was hypothesized that the ADHD group would be rated with more EC deficits in the Attention and Engagement Clusters than the LD group. It also was hypothesized that the LD group would be rated with more EC deficits in the Optimization, Efficiency and Memory Clusters than the ADHD group. It was not anticipated that the LD group would not have any clinically significant ratings in comparison to the ADHD group within the Academic and Self/Social Arena clusters rated as Executive Skill Deficits. The LD group were rated with more clinically significant Executive Function Deficit ratings within the following clusters: Efficiency and Memory. The LD group were not rated as having clinically significant Executive Function Deficit ratings within any clusters within the Academic Arena in comparison to the ADHD-

group. The ADHD group were rated with more clinically significant function deficits within the Academic Arena on the Engagement and Optimization clusters in comparison to the LD group. The ADHD group were rated with more clinically significant function deficits within the Self/Social Arena on the Optimization cluster in comparison to the LD group. The ADHD group in comparison to the LD group were rated with more clinically significant executive skill deficits within one item on the Academic Arena and within two clusters of the Self/Social Arena: Optimization and Memory clusters.

Overall results indicated that the ADHD group were rated as having a greater degree of executive dysfunction, however trends existed upon examination of the differences between ESDs and EFDs and when considering the Arena of Involvement. In most cases, much larger proportions of the ADHD group were rated as having an ESD rather than an EFD and these EFDs were more prominent within the Self/Social Arena. When considering findings for the ADHD group, much larger proportions were rated as having EFDs and ESDs in both the Academic and Self/Social Arenas. Consistent with the original hypotheses, the study supported the notion that students diagnosed with ADHD are most likely to require assistance in knowing when and how to apply self-regulation ECs within the Academic Arena and the Self/Social Arena, whereas students diagnosed with LD are most likely to require assistance in learning how and when to use self-regulation ECs within the Academic Arena, and when to use self-regulation ECs frequently within the Self/Social Arena.

Decades of research indicates that a comprehensive treatment plan for children and adolescents with ADHD must address the behavioral symptoms such as inattention, motor activity, and impulsivity along with the functional impairments that impact school performance and social relations. Students with LD require a comprehensive treatment plan that must address

academic self-regulation capacities that impact school performance. The findings of this study can support educators and clinicians with developing appropriate interventions to support students by increasing their awareness of the specific Executive Function Deficits and Executive Skill Deficits identified for school aged children with ADHD and LD. With consideration to a clinical application, the Executive Capacity profiles of the clinical groups of children with ADHD and LD used in this study can support the development of these interventions.

Limitations

Several limitations will apply to the current study. One limitation of the present study is that one standardized measure was utilized to examine the research questions. The MEFS (McCloskey, 2016) was the only measure used to identify executive function and skill deficits within and between the clinical groups. By utilizing additional EF rating scale(s) or other methods of assessing executive functions, comparisons between scales could be examined in greater depth the construct validity of the MEFS.

Additional limitations to this study include sample size and demographics of the sample. Cofounding variables and statistical limitations unaccounted for in this study serve as additional limitations. These limitations may affect the validity of the results and limit the generalizability of the findings.

Sample size.

This study consisted of a sample size of 103 students diagnosed with ADHD at the time of teacher rating, 103 demographically-matched matched control students that were not diagnosed with ADHD at the time of teacher rating, and 48 students diagnosed with LD and 48 demographically-matched controls. Due to the limited number of individuals involved in this study, the sample is not a true representation of the population and restricts the generalizability

of findings. Although the sample sizes are large enough to ensure adequate power for testing statistical significance, their relatively small size will limit the generalizability of the study findings.

Confounding teacher variables.

The validity of the teachers' ratings is limited due to the variability in factors such as teacher's age, years of teaching experience, and years of training and development that were not explored in this present study. The result might be influenced by the halo effect due to teacher bias, including varying teacher interpretations of the scale's items and varied perceptions of the students rated.

Confounding student variables.

Student factors including ethnicity and gender, that may be associated with a specific socioeconomic status, may be rated lower regarding EC based on teacher bias. While data regarding demographic characteristics of the students in the sample, such as ethnic group membership and gender, was obtained and reported, the potential impact of these demographic variables was not accounted for as a part of this study.

Additionally, this current study examined the EFDs and ESDs of those with ADHD and LD, however details regarding their level of impairment was not analyzed. Those with ADHD and LD could present with varying levels of difficulty regarding cognitive abilities, inattention, hyperactivity, impulsivity or a combination of all difficulties. Based on the DSM-V (2013) there are three possible presentations of ADHD including inattentive presentation, hyperactive/impulsive presentation, and combined presentation. Additionally, there are various categories of LD related to various processing deficits and areas of academic weakness. The students with ADHD and LD may present with various cognitive deficits not accounted for in

this current study. Further examination in this area could highlight different results between subtypes of ADHD and LD and levels of impairment which would further enhance this area of research.

Statistical limitations.

Statistical limitations exist in the current study, therefore causal implications cannot be made. Unknown mediating or moderating factors may provide alternative explanations for the results yielded in the current study.

Academic competence ratings.

The current study explored executive function and skills deficits for the clinical LD group in comparison to a matched control group. It should be noted that there was limited variability in both the LD and the matched control group's academic competence ratings. The matched control group consisted of students that do not have well developed academic skills or may potentially be identified as LD within their educational experience. As a result, the LD group and matched control group's ratings were not significantly different across multiple academic executive function and skill domains. The LD matched control group may have been a more effective control group if students were required to have high academic performance ratings. In contrast the greater variability of academic competence ratings for the ADHD and ADHD control groups allowed for more statistically significant executive function and skill deficits for the ADHD group. The lack of academic competence ratings for control groups limited the results identified for the LD group.

Future Directions

The current study explored teacher ratings of the executive function and executive skill deficits of two clinical groups and matched control groups for the items of the Self-Regulation,

Self-Realization, and Self-Determination Clusters of the McCloskey Executive Functions Scale (MEFS). Since the MEFS teacher form was the only measure utilized in the current study to evaluate and compare EC's between the groups, a future study should use multiple rating scales and/or direct assessments to examine the current or related research questions. Additionally, considering the ratings for the current study were only provided by teachers, future research using the MEFS should include parent ratings.

It is important to note the most clinically significant executive skill deficits identified by teachers were found for both the ADHD and LD group in comparison to their matched control groups within the Inquiry and Solution Clusters for the self-regulation capacities of Generate, Associate, Organize, Plan, Prioritize and Decide (Solution Cluster) and Gauge, Estimate Time, Analyze and Compare (Inquiry Cluster). Specific interventions directed at these Inquiry and Solution issues in the academic arena should be developed and utilized with individuals with ADHD and LD who may be educated within similar educational programs. This rating scale information, along with additional assessment tools, could be used to determine the efficacy of these types of interventions.

Future research could examine the executive capacities of individuals with ADHD and LD, while considering the different presentations of each clinical subgroups. Additionally, a more comprehensive evaluation of the effects of different kinds of medication, including stimulant and nonstimulant options could have on the aforementioned groups would be beneficial. Studies should also explore the impact of dosing of psychostimulants and the sequencing of combination treatments such as cognitive behavioral therapy.

REFERENCES

Alfonso, V. C., & Flanagan, D. P. (2018). *Essentials of specific learning disability identification.* Hoboken, NJ: John Wiley & Sons.

Alloway, T. P., & Alloway, R. G. (2010). Investigating the predictive roles of working memory and IQ in academic attainment. *Journal of Experimental Child Psychology, 106*(1), 20–29. doi: 10.1016/j.jecp.2009.11.003

American Psychiatric Association. *Diagnostic and Statistical Manual ofMental Disorders, Fifth edition: DSM-5.* Washington: American Psychiatric Association, 2013.

Anderson, P. (2002). Assessment and Development of Executive Function (EF) During Childhood. Child Neuropsychology, 8(2), 71-82. doi:10.1076/chin.8.2.71.8724

Ardila, A. (2008). On the evolutionary origins of executive functions. *Brain and Cognition, 68,* 92–99.

Ashkenazi, S., Black, J. M., Abrams, D. A., Hoeft, F., & Menon, V. (2013). Neurobiological underpinnings of math and reading learning disabilities. *Journal of Learning Disabilities, 46*, 549–569.

Attention-Deficit / Hyperactivity Disorder (ADHD). (2018, September 21). Retrieved from https://www.cdc.gov/ncbddd/adhd/data.html

Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions: Constructing a unifying theory of ADHD. *Psychological Bulletin, 121*(1), 65-94. doi:10.1037//0033-2909.121.1.65

Barkley, R. A. (2006). Attention-Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment (3rd ed.). New York: The Guilford Press.

Barkley, R. (2018). Executive functions: What they are, how they work,and why they evolved. New York: The Guilford Press.

Barkley, R. A. (2015). Attention-deficit hyperactivity disorder: A handbook for diagnosis and treatment. New York: The Guilford Press.

Barkley, R. A., & Peters, H. (2012). The earliest reference to ADHD in the medical literature?: Melchior Adam Weikard's description in 1775 of "Attention Deficit" (Mangel der Aufmerksamkeit, attentio volubilis). *Journal of Attention Disorders, 16,* 623–630.

Beck, J.S. (1995). *Cognitive Therapy: Basics and Beyond.* New York, NY: The Guilford Press.

Berninger, V. W., Abbott, R. D., Abbott, S. P., Graham, S., & Richards, T. (2002). Writing and reading: Connections between language by hand and language by eye. *Journal of Learning Disabilities, 35,* 39-56.

Biederman, J., Keenan, K., & Faraone, S. V. (1990). Parent-based diagnosis of attention deficit disorder predicts a diagnosis based on teacher report. *American Journal of Child and Adolescent Psychiatry, 29,* 698–701.

Butnik, S. M. (2005). Neurofeedback in adolescents and adults with attention deficit hyperactivity disorder [Special issue: ADHD in adolescents and adults]. *Journal of Clinical Psychology, 61*, 621−625.

Chronis, A. M., Jones, H. A., & Raggi, V. L. (2006). Evidence-based psychosocial treatment for children and adolescents with Attention-Deficit/Hyperactivity Disorder. *Clinical Psychology Review, 26,* 486-502.

Clements, D., & Sarama, J. (2014). *The importance of the early years. Science, technology, & mathematics (STEM)*. Thousand Oaks, CA: Corwin.

Cottrell, J. M., & Barrett, C. A. (2015). Defining the undefinable: operationalization of methods to identify specific learning sisabilities among pacticing school psychologists. *Psychology in the Schools, 53*(2), 143-157. doi:10.1002/pits.21892

Dawson, P., & Guare, R. (2018). *Executive skills in children and adolescents: A practical*

guide to assessment and intervention. Guilford Press, 2018.

Decker, S. L., Hale, J. B., & Flanagan, D. P. (2013). Professional Practice Issues In The Assessment Of Cognitive Functioning For Educational Applications. Psychology in the Schools, 50(3), 300-313. doi:10.1002/pits.21675

Delis, D. C. (2012). *Delis-rating of executive function*. Pearson Clinical.

Delis, D. C., Kaplan, E., & Kramer, J. H. (2001). *Delis-Kaplan executive function system.* San Antonio, TX: Pearson Clinical.

Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition. (DSM-5) American Psychiatric Association. American Psychiatric Association Publishing. 2013.

Diamond, A. (2005). Attention-deficit disorder (attention-deficit/hyperactivity disorder without hyperactivity): A neurobiologically and behaviorally distinct disorder from attention deficit/hyperactivity disorder (with hyperactivity). *Development and Psychopathology, 17*, 807-825. doi:10.1017/S0954579405050388

Dirks, M. A., Treat, T. A., & Weersing, V. R. (2007). Integrating theoretical, measurement, and intervention models of youth social competence. *Clinical Psychology Review, 27*(3), 327–347.

Dupaul, George J. (2012). Comorbidity of LD and ADHD. Journal of Learning Disabilities, 46(1), 43–51., doi:10.1177/0022219412464351.

DuPaul, G. J., & Eckert, T. L. (1994). The effects of social skills curricula: Now you see them, now you don't. *School Psychology Quarterly*, *9*(2), 113–132.

Esters, I. G., Ittenbach, R. F., Han, K. (1997). Today's IQ tests: Are they really better than their historical predecessors?, *School Psychology Review*, *26*(2).

Eyberg, S. M., Nelson, M. M., & Boggs, S. R. (2008). Evidence-based psychosocial treatments

for children and adolescents with disruptive behavior. *Journal of Clinical Child and Adolescent Psychology, 37*, 215–237.

Feifer, S. G., & Della Toffalo, D. A. (2007). *Integrating RTI with cognitive neuropsychology: A scientific approach to reading*. Middletown, MD: School Neuropsych Press.

Feifer, S. G. (2011). *How SLD manifests in reading. In D. P. Flanagan & V. C. Alfonso (Eds.), Essentials of specific learning disability identification* (pp. 21–42). Hoboken, NJ: Wiley.

Finn, E. S., Shen, X., Holahan, J. M., Scheinost, D., Lacadie, C., Papademetris, X., . . . Constable, R. T. (2014). Disruption of functional networks in Dyslexia: A whole-brain, data-driven analysis of connectivity. *Biological Psychiatry, 76*(5), 397-404.doi:10.1016/j.biopsych.2013.08.031

Flanagan, D. P., & Schneider, W. J. (2016). Cross-battery assessment? XBA PSW? A case of mistaken identity: A commentary on Kranzler and colleagues' "Classification agreement analysis of Cross-Battery Assessment in the identification of specific learning disorders in children and youth."

International Journal of School & Educational Psychology, 4(3), 137–145.

Flanagan, D. P. (2008). The Cattell-Horn-Carroll theory of cognitive Abilities. *Encyclopedia of Special Education*. doi:10.1002/9780470373699.speced0381

Fletcher, J. M., Stuebing, K. K., Barth, A. E., Denton, C. A., Cirino, P. T., Francis, D. J., & Vaughn, S. (2011). Cognitive correlates of inadequate response to intervention. School Psychology Review , 40 , 2–22.

Fox, D. J., Tharp, D. F., & Fox, L. C. (2005). Neurofeedback: An Alternative and Efficacious Treatment for Attention Deficit Hyperactivity Disorder. Applied Psychophysiology and Biofeedback, 30(4), 365-373. doi:10.1007/s10484-005-8422-3

Fuchs, L. S. (2003). Assessing intervention responsiveness: Conceptual and technical issues. *Learning Disabilities Research & Practice, 18,* 172–186.

Fuchs, L., & Fuchs, D. (2001). Principles for the prevention and intervention of mathematics difficulties. Learning Disabilities Research and Practice, 16(2), 85-95. doi:10.1111/0938-8982.00010

Learning Disabilities Research & Practice, 28(2). (2013). doi:10.1111/ldrp.2013.28.issue-2

Fuster, J. M. (1997). The prefrontal cortex. New York: Raven.

Gallant, S.N. (2016). Mindfulness meditation practice and executive functioning: Breaking down the benefit. *Consciousness and Cognition, 40,* 116-130.

Gioia, G. A., Isquith, P. K., Guy, S. C., Kenworthy, L. (2000). BRIEF—*Behavior rating inventory of executive function: Professional manual.* Odessa, FL: Psychological Assessment Resources.

Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2015). *Behavior rating inventory of executive function-second edition.* Torrance, CA: Western Psychological Services

Goldman-Rakic, P. S. (2001). The CEO of cerebral promontory. The Executive Brain: Frontal Lobes and the Civilized Mind. *Cerebrum* Retrieved from http://www.dana.org/Cerebrum/2001/The_CEO_of_the_Cerebral_Promontory/

Goldstein, S., Naglieri, J. A., Princiotta, D., & Otero, T. M. (2013). Introduction: *A history of executive functioning as a theoretical and clinical construct. Handbook of executive functioning*, 3-12. doi:10.1007/978-1-4614-8106-5_1

Graham, S., & Harris, K. R. (2009). Almost 30 years of writing research: Making sense of it all with the Wrath of Khan. *Learning Disabilities Research & Practice, 24,* 58–68.

Groenewegen, H. J., Wright, C. I., & Uylings, H. B. (1997). The anatomical relationships of the

prefrontal cortex with limbic structures and the basal ganglia. *Journal of Psychopharmacology (Oxford, England), 11*(2), 99-106.

Habboushe, D. F., Daniel-Crotty, S., Karustis, J. L., Leff, S. S., Costigan, T. E., Goldstein, S. G., . . . Power, T. J. (2001). A family-school homework intervention program for children with attention-deficit/hyperactivity disorder. Cognitive and Behavioral Practice, 8(2), 123-136. doi:10.1016/s1077-7229(01)80018-3

Hendren, R. L., De Backer, I., & Pandina, G. J. (2000). Review of neuroimaging studies of child and adolescent psychiatric disorders from the past 10 years. *Journal of the American Academy of Child and Adolescnt Psychiatry*, *39*, 815–828.

Horowitz-Kraus, T., Vannest, J. J., Kadis, D., Cicchino, N., Wang, Y. Y., & Holland, S. K. (2014). *Reading acceleration training changes brain circuitry in children with reading difficulties. Brain and Behavior, 4*(6), 886–902.

Ihori, D., & Olvera, P. (2014). Discrepancies, responses, and patterns: Selecting a method of assessment for specific learning disabilities. *Contemporary School Psychology, 19*(1), 1-11. doi:10.1007/s40688-014-0042-6

Karagiannakis, G., Baccaglini-Frank, A., & Papadatos, Y. (2014). Mathematical learning difficulties subtypes classification. *Frontiers in Human Neuroscience, 8*. doi:10.3389/fnhum.2014.00057

Kaufman, A. S. (2008). *Neuropsychology and specific learning disabilities: Lessons from the past as a guide to present controversies and future clinical practice.* In E. Fletcher-Janzen & C.R. Reynolds (Eds)., Neuropsychological perspectives on learning disabilities in the era of R.T.I.: Recommendations for diagnosis and interventions (pp 1-13). Hoboken, NHJ: Wiley.

Kanaya, T. (2016). Discussing the Flynn Effect: From causes and interpretation to implications. *Measurement: Interdisciplinary Research and Perspectives, 14*(2), 67-69. doi:10.1080/15366367.2016.1171607

Kavale, K. A., & Flanagan, D. P. (2007). *Ability—achievement discrepancy, response to intervention, and assessment of cognitive abilities/processes in specific learning disability identification: Toward a contemporary operational definition.* Handbook of Response to Intervention, 130-147. doi:10.1007/978-0-387-49053-3_10

Kavale, K. A. & Forness, S. R. (2006) *Learning disability as a discipline.* In H.L. Swanson, K.R. Harris, & S. Graham (Eds.), Handbook of Learning disabilities (pp. 76-93). New York, NY: Guilford.

Kearns, D. M., & Fuchs, D. (2013). Does cognitively focused instruction improve the academic performance of low-achieving students? Exceptional Children, 79, 263-290.

Korkman, M., Kirk, U. & Kemp, S. (2007). NEPSY Second Edition. San Antonio, TX: Pearson Clinical. Learning Disabilities Association of America. (n.d.). Retrieved August 08, 2018, from https://ldaamerica.org/

Langberg, J. M., Epstein, J. N., Girio-Herrera, E., Becker, S. P., Vaughn, A. J., & Altaye, M. (2011). Materials Organization, Planning, and Homework Completion in Middle-School Students with ADHD: Impact on Academic Performance. School Mental Health, 3(2), 93-101. doi:10.1007/s12310-011-9052-y

Levy, F., & Hay, D. (1992, February). ADHD in twins and their siblings. Paper presented at the annual meeting of the International Society for Research in Child and Adolescent Psychopathology, Sarasota, FL.

Lewis, K. E., & Fisher, M. B. (2016). Taking stock of 40 years of research on mathematical

learning disability: Methodological issues and future directions. *Journal for Research in Mathematics Education, 47*(4), 338–371.

Luria, A. R. (1966). Higher cortical functions in man. New York: Basic Books.

Maki, K. E., Floyd, R. G., & Roberson, T. (2015). State learning disability eligibility criteria: A comprehensive review. *School Psychology Quarterly, 30*, 457–469.

McCandless, S., O'Laughlin, L. (2007). The clinical utility of the Behavior Rating Inventory of Executive Function (BRIEF) in the diagnosis of ADHD. *Journal of Attention Disorders, 10*, 381-389. doi:10.1177/1087054706292115

McCloskey, G., Perkins, L. A., & Divner, B. V. (2009). *Assessment and intervention for executive function difficulties*. New York: Routledge.

McCloskey, G & Perkins, L. A. (2012). *Essentials of executive functions assessment.* Hoboken, NJ: Wiley & Sons.

McCloskey, G. (2016). *McCloskey Executive Functions Scale (MEFS)*. Stoddard, Schoolhouse Educational Services, LLC.

McFarland, J., Hussar, B., Wang, X., Zhang, J., Wang, K., Rathbun, A., Barmer, A., Forrest Cataldi, E., & Bullock Mann, F. (2018). The Condition of Education 2018 (NCES 2018-144). U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved [date] from https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2018144.

Meltzer, L. (2010). *Promoting executive function in the classroom*. Guilford Publications.

Mikami, A. Y., Ransone, M. L., & Calhoun, C. D. (2011). Influence of anxiety on the social functioning of children with and without ADHD. *Journal of Attention Disorders, 15*(6), 473–484.

Miller, D. C. (2013). *Essentials of school neuropsychological assessment.* Wiley.

Mongia, M., & Hechtman, L. (2012). Cognitive behavior therapy for adults with attention-deficit/hyperactivity disorder: A review of recent randomized controlled trials. *Current Psychiatry Reports, 14*(5), 561-567.

Naglieri, J. A., & Das, J. P. (2005). *Planning, attention, simultaneous, successive (PASS) theory: A revision of the concept of intelligence.* In D. P. Flanagan and P. L. Harrison (Eds.), Contemporary intellectual assessment (2nd ed., pp. 136–182). New York, NY: Guilford.

Naglieri, J. A. & Goldstein, S. (2012). *Comprehensive Executive Function Inventory*. MHS Assessments.

National Joint Committee on Learning Disabilities. (1998). Operationalizing the NJCLD definition of learning disabilities for ongoing assessment in schools. Asha , 40 (18), 258a–g. Retrieved from: www.asha.org/policy/RP1998-00130/

Newark, P., & Stieglitz, R. (2010). Therapy-relevant factors in adult ADHD from a cognitive behavioural perspective. *ADHD Attention Deficit and Hyperactivity Disorders, 2*(2), 59-72.

Newton, K. J., Sperling, R. A., & Martin, A. J. (2017). Learning disabilities, attention-deficit hyperactivity disorder, and executive functioning: Contributions from educational psychology in progressing theory, measurement, and practice. *Contemporary Educational Psychology, 50,* 1-3. doi:10.1016/j.cedpsych.2016.12.003

Nigg, J. T., & Casey, B. J. (2005). An integrative theory of attention-deficit/ hyperactivity disorder based on the cognitive and affective neurosciences. *Development and Psychopathology, 17,* 765–806.

Nixon, E. (2001). The social competence of children with attention deficit hyperactivity disorder:

A review of the literature. *Child and Adolescent Mental Health,* 6(4), 172–180.

Onnink, A. M., Zwiers, M. P., Hoogman, M., Mostert, J. C., Dammers, J., Kan, C. C., . . . Franke, B. (2015). Deviant white matter structure in adults with attention-deficit/hyperactivity disorder points to aberrant myelination and affects neuropsychological performance. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 63*, 14-22. doi:10.1016/j.pnpbp.2015.04.008

Pauls, D. L. (1991). Genetic factors in the expression of attention-deficit hyperactivity disorder. *Journal of Child and Adolescent Psychopharmacology, 1*, 353–360.

Pennington, B. F. (2008). *Diagnosing learning disabilities*. New York, NY: Guilford.

Pietschnig, J. (2016). The Flynn Effect: Technology may be part of it, but is most certainly not all of it. *Measurement: Interdisciplinary Research and Perspectives, 14*(2), 70-73. doi:10.1080/15366367.2016.1171612

Pfiffner, L. J. (2008). Social skills training. In K. McBurnett & L. J. Pfiffner (Eds.), *Attention-deficit/hyperactivity disorder: Concepts, controversies, new directions* (pp. 179–190). New York: Informa Healthcare.

Purdie, N., Hattie, J., Carroll, A., (2002). A review of the research on interventions for attention deficit hyperactivity disorder: What works best? *Review of Educational Research, 72,* pp. 61-99

Reiter, A., Tucha, O., & Lange, K. W. (2005). Executive functions in children with dyslexia. *Dyslexia, 11*, 116–131.

Reid, R., Trout, A. L., & Schartz, M. (2005). Self-regulation interventions for children with attention deficit/ hyperactivity disorder. *Exceptional Children, 71*, 361–377.

Restori, A. F., Katz, G. S., & Lee, H. B. (2009). *A critique of the IQ / achievement discrepancy*

model for identifying specific learning disabilities. PsycEXTRA Dataset. doi:10.1037/e676802011-009

Scanlon, D. (2012). Specific Learning Disability and its newest definition. *Journal of Learning Disabilities, 46*(1), 26-33. doi:10.1177/0022219412464342

Schachter HM, Pham B, King J, Langford S, Moher D. How efficacious and safe is short-acting methylphenidate for the treatment of attention-deficit disorder in children and adolescents? A meta-analysis. CMAJ. 2001;165:1475–88.

Schuchardt, Kirsten, et al. (2008) Working Memory Deficits in Children With Specific Learning Disorders. *Journal of Learning Disabilities, 41*(6), 514–523., doi:10.1177/0022219408317856.

Shaw, P., Eckstrand, K., Sharp, W., Blumenthal, J., Lerch, J. P., Greenstein, D., et al. (2007). Attention-deficit/hyperactivity disorder is characterized by a delay in cortical maturation. *Proceedings of the National Academy of Sciences, 104*(49), 19649–19654.

Shaywitz, S., & Shaywitz, B. (2004). Reading disability in the brain. *Educational Leadership, 61*(6), 6-11. Retrieved February 02, 2019, from http://www.educationalleader.com/subtopicintro/read/ASCD/ASCD_323_1.pdf

Stuss, D. T., & Alexander, M. P. (2000). Executive functions and the frontal lobes: A conceptual view. Psychological Research, 63(3-4), 289-298. doi:10.1007/s004269900007

Spencer, T., Biederman, J., Wilens, T., Harding, M., Odonnell, D., & Griffin, S. (1996). Pharmacotherapy of Attention-Deficit Hyperactivity Disorder across the Life Cycle. Journal of the American Academy of Child & Adolescent Psychiatry, 35(4), 409-432. doi:10.1097/00004583-199604000-00008

Taylor, E. (2011). Antecedents of ADHD: A historical account of diagnostic concepts. *Attention*

Deficit Hyperactivity Disorder, 3(2), 69–75.

Taylor, W. P., Miciak, J., Fletcher, J. M., & Francis, D. J. (2017). Cognitive discrepancy models for specific learning disabilities identification: Simulations of psychometric limitations. *Psychological Assessment, 29*(4), 446-457. doi:10.1037/pas0000356

Thiebaut de Schotten, M., Dell'Acqua, F., Valabregue, R., & Catani, M. (2012). Monkey to human comparative anatomy of the frontal lobe association tracts. *Cortex; a Journal Devoted to the Study of the Nervous System and Behavior, 48*(1), 82-96.

Toplak, M. E., Connors, L., Shuster, J., Knezevic, B., & Parks, S. (2008). Review of cognitive, cognitive-behavioral and neural-based interventions to Attention-Deficit/Hyperactivity Disorder (ADHD). *Clinical Psychology Review, 28*, 801-823.

Tyson, B., Lantrip, C., & Roth, R. M. (2014). Cerebellar contributions to implicit learning and executive functions. *Cognitive Sciences, 9,* 179-217.

United States Department of Education, Individuals with Disabilities Education Act (IDEA) (2004).

Usher, A. M., Leon, S. C., Stanford, L. D., Holmbeck, G. N., & Bryant, F. B. (2015). Confirmatory factor analysis of the Behavior Rating Inventory of Executive Functioning (BRIEF) in children and adolescents with ADHD. *Child Neuropsychology, 22*(8), 907-918. doi:10.1080/09297049.2015.1060956

VanDerHeyden, A. M., & Burns, M. K. (2010). *Essentials of response to intervention*. New York, NY: Wiley.

Van der Oord, S., Prins, P. J. M., Ossterlaan, J., & Emmelkamp, P. M. G. (2008). Efficacy of methylphenidate, psychosocial treatments and their combination in school-aged children with ADHD: A meta-analysis. *Clinical Psychology Review, 28,* 783-800.

Vasilopoulos, T., Franz, C. E., Panizzon, M. S., Xian, H., Grant, M. D., Lyons, M. J., . . . Kremen, W. S. (2012). Genetic architecture of the Delis-Kaplan executive function system Trail Making Test: Evidence for distinct genetic influences on executive function. Neuropsychology, 26(2), 238-250. doi:10.1037/a0026768

Vaughn, S., & Fuchs, L. S. (2006). A response to "Competing views: A dialogue on response to intervention": Why response to intervention is necessary but not sufficient for identifying students with learning disabilities. *Assessment for Effective Intervention, 32*, 58–61.

Visalakshi, N., & Thenmozhi, S. (2011). Executive functions of children with learning problems. *Indian Journal of Community Psychology, 7*(1), 12-19. Retrieved from http://www.ijcpind.com/wp-content/uploads/2011/12/cpai_march2011.pdf#page=12

Williams, P. G. &Thayer, J. F. (2009). Executive functioning and health: Introduction to the special series. *Annual Behavioral Medicine, 37,* 101-105.

APPENDICES

Appendix A. McCloskey Executive Functions Scale (MEFS) – School Age Teacher Form

5	AA	Always or almost always does this on his or her own. Does not need to be prompted or reminded (cued) to do it.
4	F	Frequently does this on own without prompting
3	S	Seldom does this on own without being prompted, reminded, or cued to do so.
2	AP	Does this only after being prompted, reminded, or cued to do it.
1	DA	Only does it with direct assistance. Requires much more than a simple prompt or cue to be able to get it done in situations that require it.
0	UA	Unable to do this, even when direct assistance is provided.

BECOMING AWARE						
Knows what he or she should be doing for school tasks and knows when to do it.	AA	F	S	AP	DA	UA
Makes eye contact with, listens to, and touches others in an appropriate way in social situations.	AA	F	S	AP	DA	UA
FOCUSING ATTENTION						
Focuses attention on school tasks.	AA	F	S	AP	DA	UA
Focuses attention on others in social situations.	AA	F	S	AP	DA	UA
SUSTAINING ATTENTION						
Sustains attention for school tasks until a task is completed.	AA	F	S	AP	DA	UA
Sustains attention to others in social situations.	AA	F	S	AP	DA	UA
INITIATING						
Starts school work.	AA	F	S	AP	DA	UA
Initiates socially appropriate interactions with other students.	AA	F	S	AP	DA	UA
GETTING ENERGIZED FOR / PUTTING EFFORT INTO						

Puts adequate energy into, school tasks.	AA	F	S	AP	DA	UA
Puts adequate energy into, interacting with others.	AA	F	S	AP	DA	UA
INHIBITING						
Waits for turn.	AA	F	S	AP	DA	UA
Considers the consequences before saying or doing things he or she may regret.	AA	F	S	AP	DA	UA
Refrains from acts of physical aggression.	AA	F	S	AP	DA	UA
Does not make inappropriate or thoughtless comments (for example, name-calling, insulting, inappropriately tattling on others).	AA	F	S	AP	DA	UA
Maintains emotional control in frustrating situations.	AA	F	S	AP	DA	UA
Maintains emotional control when doing challenging school work.	AA	F	S	AP	DA	UA
Maintains emotional control when disagreeing with others.	AA	F	S	AP	DA	UA
STOPPING						
Knows when to stop talking about a single topic.	AA	F	S	AP	DA	UA
Stops playing a game or stops doing something that is fun when asked to do so.	AA	F	S	AP	DA	UA
Stops doing things that annoy others when asked to do so.	AA	F	S	AP	DA	UA
PAUSE & CONTINUE						
Returns to a school task after a brief pause.	AA	F	S	AP	DA	UA
Pauses to listen to what another person has to say during conversations.	AA	F	S	AP	DA	UA
FLEXIBLY ENGAGING						
Willing to try a different way to do school tasks when he or she gets stuck.	AA	F	S	AP	DA	UA
Accepts a good idea when it is what most others in a group want to do.	AA	F	S	AP	DA	UA

Accepts changes in school work or school routines without getting upset about it.	AA	F	S	AP	DA	UA
Accepts changes in a person he or she knows or to accept unfamiliar persons without getting upset.	AA	F	S	AP	DA	UA
SHIFTING						
Moves from one school task to another without difficulty.	AA	F	S	AP	DA	UA
Changes from one activity to another in social situations without difficulty.	AA	F	S	AP	DA	UA
MONITORING						
Checks school work to avoid careless errors on tests and other school work.	AA	F	S	AP	DA	UA
Recognizes situations in which his or her behavior bothers or upsets others.	AA	F	S	AP	DA	UA
Checks to make sure that he or she has everything they need before leaving class or school.	AA	F	S	AP	DA	UA
Checks on his or her appearance, cleanliness and personal hygiene.	AA	F	S	AP	DA	UA
MODULATING OR ADJUSTING						
Physical activity level fits the situation when doing school tasks (Not hyperactive or inactive).	AA	F	S	AP	DA	UA
Physical activity level fits the situation when working in a group (Not hyperactive or inactive).	AA	F	S	AP	DA	UA
Emotional response fits the situation when working on school tasks (Doesn't overreact or underact).	AA	F	S	AP	DA	UA
Emotional response fits the situation when interacting with others (Doesn't overreact or underreact).	AA	F	S	AP	DA	UA
Avoids being overstimulated or understimulated by sights, sounds, or touches.	AA	F	S	AP	DA	UA
CORRECTING						
Corrects errors that are made in school work.	AA	F	S	AP	DA	UA

Apologizes when aware of offending others.	AA	F	S	AP	DA	UA
BALANCING						
Balances the elements of a school assignment (speed vs accuracy, quality vs quantity; general vs specific statements; depth vs breadth, etc.).	AA	F	S	AP	DA	UA
Maintains a balance in social situations (talking vs listening, sharing too much vs sharing too little; being humorous vs being serious).	AA	F	S	AP	DA	UA
Maintains a balance in his or her own activities (play vs work; time alone vs time with others; sleep vs awake).	AA	F	S	AP	DA	UA
SENSING TIME						
Keeps track of time (e.g., realizes how much time has passed) when doing school tasks.	AA	F	S	AP	DA	UA
Keeps track of time (e.g., realizes how much time has passed) when talking to or doing things with others.	AA	F	S	AP	DA	UA
PACING						
Changes pace (works slower or works faster) when taking tests or doing school assignments.	AA	F	S	AP	DA	UA
Changes pace in social situations (for example, talks slower or talks faster to maintain the pace of the conversation).	AA	F	S	AP	DA	UA
USING ROUTINES/COMPLETING ASSIGNMENTS (EXECUTING)						
Uses well-rehearsed or practiced routines for school tasks (for example, recognizing words by sight, printing or writing letters and words, reciting basic math facts).	AA	F	S	AP	DA	UA
Uses well-rehearsed or practiced social greetings or conversation starters.	AA	F	S	AP	DA	UA
Generate good ideas and gets them down on paper quickly and efficiently.	AA	F	S	AP	DA	UA
Uses routines and strategies to do well on tests.	AA	F	S	AP	DA	UA

Uses routines and strategies to get assignments and projects done.	AA	F	S	AP	DA	UA
Participates in discussions about topics that he or she knows a lot about.	AA	F	S	AP	DA	UA
Brings home all the materials need to complete homework and other school tasks.	AA	F	S	AP	DA	UA
Hands in homework, assignments or important papers when they are completed.	AA	F	S	AP	DA	UA
SEQUENCING						
Gets the steps in the right order when working on school tasks.	AA	F	S	AP	DA	UA
Gets the order of events right when telling stories or explaining things to others.	AA	F	S	AP	DA	UA
HOLDING and WORKING WITH INFORMATION IN MIND						
Can keep information in mind for short periods of time when doing school tasks. (For example, can add 3 or more numbers without pencil and paper; can remember directions that were just given by the teacher.)	AA	F	S	AP	DA	UA
Can keep information in mind for short periods of time when talking with others. (For example, can follow and participate in a longer conversation.)	AA	F	S	AP	DA	UA
STORING and RETRIEVING						
Stores and recalls specific information about school subjects no matter how questions are worded.	AA	F	S	AP	DA	UA
Stores and recalls specific information about others or about social situations.	AA	F	S	AP	DA	UA
Does well on tests that require recall of stored facts no matter what test format is used.	AA	F	S	AP	DA	UA
Does well in social situations that require recall of facts about others.	AA	F	S	AP	DA	UA
Does well in situations that require recall of facts about himself or herself.	AA	F	S	AP	DA	UA

GAUGING or "SIZING UP"						
Accurately estimates the difficulty of school tasks and/or tests and what it takes to complete them and/or do well with them.	AA	F	S	AP	DA	UA
Figures out how to interact appropriately in various social situations.	AA	F	S	AP	DA	UA
ANTICIPATING						
Anticipates events at school. (for example, recognizes the need to prepare for tests or assignments; connects homework with grades, etc.).	AA	F	S	AP	DA	UA
Anticipates how what he or she says or does will affect how others feel, think or act.	AA	F	S	AP	DA	UA
Anticipates the consequences of his or her own thoughts, feeling and actions. (for example, recognizes that if he or she doesn't do a chore he or she won't be able to play with a friend and will feel disappointed about it).	AA	F	S	AP	DA	UA
ESTIMATING TIME						
Accurately estimates how long it will take to do something when involved with one or more school tasks.	AA	F	S	AP	DA	UA
Accurately estimates how long it will take to do something when talking to others or doing things with others.	AA	F	S	AP	DA	UA
ANALYZING SITUATIONS						
Examines and analyzes things in more detail when doing school tasks.	AA	F	S	AP	DA	UA
Examines and analyzes in more detail what others are saying or doing in social situations.	AA	F	S	AP	DA	UA
EVALUATING / COMPARING						
Evaluates the quality and/or adequacy of his or her work on school tasks.	AA	F	S	AP	DA	UA
Evaluates the quality and/or adequacy of his or her social interactions.	AA	F	S	AP	DA	UA

GENERATING SOLUTIONS						
Comes up with new ways to solve problems with school tasks.	AA	F	S	AP	DA	UA
Come up with new ideas about things to say to, or do with, others.	AA	F	S	AP	DA	UA
MAKING ASSOCIATIONS						
Sees or understands how two or more things or ideas are similar and can use that knowledge to solve a problem with school work.	AA	F	S	AP	DA	UA
Sees or understands how one social situation can be similar to another and can use that knowledge to solve a social relationship problem.	AA	F	S	AP	DA	UA
ORGANIZING						
Organizes school tasks.	AA	F	S	AP	DA	UA
Organizes age appropriate social activities.	AA	F	S	AP	DA	UA
PLANNING						
Makes plans for school tasks.	AA	F	S	AP	DA	UA
Makes plans for age appropriate social activities.	AA	F	S	AP	DA	UA
Makes plans for the use of his or her own time.	AA	F	S	AP	DA	UA
PRIORITIZING						
Orders school tasks according to their relevance, importance, or urgency.	AA	F	S	AP	DA	UA
Handles social activities according to their relevance, importance or urgency.	AA	F	S	AP	DA	UA
DECISION-MAKING						
Makes own decisions about what to do for school and/or when to do it.	AA	F	S	AP	DA	UA
Makes own decisions about what to do with others and/or when to do it.	AA	F	S	AP	DA	UA

INSTRUCTIONS

For each statement below, think about this student and circle the option that best describes him or her:

N/R Never or rarely does this.

S Does this sometimes, but not much

O Does this often

VO Does this very often

SELF-REALIZATION: AWARENESS OF SELF				
Makes realistic comments about his or her own mental and emotional strengths and weaknesses.	N/R	S	O	VO
Makes realistic comments about his or her own physical abilities.	N/R	S	O	VO
Makes realistic comments about what he or she feels or thinks about himself or herself.	N/R	S	O	VO
SELF-REALIZATION: AWARENESS OF OTHERS				
Makes realistic comments about the mental and emotional strengths and weaknesses of others.	N/R	S	O	VO
Makes realistic comments about the physical abilities of others.	N/R	S	O	VO
Makes realistic comments about what he or she thinks other people feel or think about others.	N/R	S	O	VO
Makes realistic comments about what he or she thinks others feel or think about him or her.	N/R	S	O	VO
Makes realistic comments about what he or she thinks other people feel or think about themselves.	N/R	S	O	VO
SELF-REALIZATION: ANALYSIS OF SELF AND OTHERS				
Realistically analyzes and comments about his or her school performance.	N/R	S	O	VO

Realistically analyzes and comments about his or her ability to know what others appear to think or feel about him or her.	N/R	S	O	VO
Realistically analyzes and comments about his or her ability to manage himself or herself.	N/R	S	O	VO
SELF-DETERMINATION: GOAL-SETTING				
States realistic goals for schooling based on personal interests.	N/R	S	O	VO
States realistic goals for work beyond school based on personal interests.	N/R	S	O	VO
Expresses strong desires to make his or her own decisions about what to do rather than be told what to do by parents or others.	N/R	S	O	VO
SELF-DETERMINATION: LONG-TERM PLANNING				
States realistic plans for accomplishing long-term schooling goals.	N/R	S	O	VO
States realistic plans for accomplishing long-term work goals.	N/R	S	O	VO
States realistic plans for accomplishing social and/or personal goals.	N/R	S	O	VO

Appendix B: Fisher's Z Analyses

ADHD VS CONTROLS	ADHDC ON	LDCO N	LD	ADHD	ADHD	LD	ADHD-LD	
EFD					Sig. Level	Sig. Level	Sig. Level	
	% for 1s	% for 3s	% for 3s	% for 1s	p < ___	p < ___	p < ___	Fisher's z
ATN1PA	22%	40%	44%	47%*	0.001	0.679	0.743	0.328
ATN3FA	31%	46%	50%	57%*	0.001	0.683	0.403	0.837
ATN5SA	33%	48%	42%	61%*	0.001	0.538	0.025	2.243
ATN2PS	15%	25%	31%	31%*	0.002	0.496	0.982	-0.022
ATN4FS	18%	23%	23%	32%*	0.001	1.000	0.251	1.149
ATN6SS	18%	19%	27%	40%*	0.001	0.332	0.129	1.519
ENG7IA	25%	0%	46%*	53%*	0.001	0.001	0.387	0.866
ENG9EA	28%	46%	46%	52%*	0.001	1.000	0.45	0.755
ENG16HA	16%	23%	15%	45%*+	0.001	0.296	0.001	3.606
ENG19SA	26%	31%	25%	44%*	0.004	0.496	0.027	2.206
ENG22PA	20%	35%	46%	51%*	0.001	0.299	0.519	0.644
ENG24FA	23%	38%	38%	49%*	0.001	1.000	0.204	1.27
ENG26FA	14%	19%	10%	28%*	0.005	0.247	0.015	2.43
ENG28TA	23%	27%	21%	46%*+	0.001	0.473	0.003	2.927
ENG8IS	17%	17%	35%	30%*	0.001	0.036	0.513	-0.654
ENG10ES	17%	19%	42%	28%	0.033	0.015	0.049	-1.651
ENG11HS	16%	10%	21%	40%*	0.001	0.160	0.022	2.295
ENG12HS	30%	27%	29%	43%	0.03	0.820	0.111	1.594
ENG13HS	10%	13%	15%	15%	0.143	0.766	0.998	-0.003
ENG14HS	21%	25%	19%	38%*	0.005	0.459	0.019	2.349
ENG15HS	18%	19%	21%	41%*	0.001	0.798	0.016	2.402
ENG17HS	20%	19%	23%	42%*	0.001	0.615	0.025	2.248
ENG18SS	24%	27%	31%	45%*	0.001	0.653	0.118	1.564
ENG20SS	20%	17%	29%	43%*	0.001	0.145	0.111	1.504
ENG23PS	15%	10%	38%*	38%*	0.001	0.002	0.966	0.043
ENG25FS	15%	21%	21%	35%*	0.001	1.000	0.079	1.755
ENG27FS	11%	17%	17%	18%	0.057	1.000	0.79	0.266
ENG29TS	13%	15%	21%	38%*	0.001	0.423	0.037	2.081
OPT35NA	16%	54%	46%	44%*	0.001	0.415	0.805	-0.247
OPT37NA	15%	44%	46%	41%*	0.001	0.838	0.558	-0.586

OPT30DA	18%	25%	21%	42%*+	0.001	0.627	0.012	2.507
OPT32DA	27%	23%	27%	47%*	0.001	0.638	0.023	2.276
OPT39CA	36%	48%	58%	62%*	0.001	0.306	0.656	0.446
OPT43BA	24%	50%	40%	60%*	0.001	0.305	0.018	2.365

OPT36NS	17%	29%	35%	43%*	0.001	0.513	0.395	0.851
OPT38NS	19%	13%	23%	46%*+	0.001	0.181	0.008	2.672
OPT31DS	39%	21%	29%	55%*+	0.001	0.346	0.003	3.001
OPT33DS	27%	17%	33%	50%*	0.001	0.059	0.049	1.973
OPT34DS	18%	17%	27%	33%*	0.001	0.217	0.464	0.732
OPT40CS	21%	25%	33%	39%*	0.001	0.369	0.514	0.652
OPT44BS	22%	29%	48%	47%*	0.001	0.059	0.88	-0.151
OPT45BS	24%	31%	48%	51%*	0.001	0.095	0.686	0.405
EFF72TA	39%	48%	52%	47%	0.125	0.683	0.53	-0.628
EFF74PA	40%	50%	52%	48%	0.131	0.838	0.606	-0.516
EFF76RA	24%	35%	50%	39%*	0.012	0.149	0.196	-1.293
EFF79RA	40%	50%	50%	53%	0.025	1.000	0.697	0.389
EFF80RA	31%	50%	48%	50%*	0.003	0.838	0.855	0.183
EFF81RA	31%	35%	52%	50%*	0.002	0.099	0.855	-0.183
EFF82RA	19%	25%	35%	23%	0.248	0.267	0.119	-1.559
EFF83RA	23%	33%	44%	52%*	0.001	0.294	0.321	0.993
EFF84RA	19%	29%	40%	43%*	0.001	0.283	0.716	0.364
EFF85SA	21%	38%	58%	42%*	0.001	0.041	0.057	-1.901

EFF73TS	40%	38%	48%	51%	0.046	0.302	0.686	0.405
EFF75PS	29%	25%	65%*	50%*	0.001	0.001	0.084	-1.731
EFF77RS	18%	17%	40%*	28%	0.049	0.012	0.16	-1.404
EFF86SS	16%	21%	60%*+	37%*	0.001	0.001	0.007	-2.709
MEM87MA	19%	29%	50%	43%*	0.001	0.037	0.403	-0.837
MEM89RA	26%	42%	65%	46%*	0.001	0.024	0.03	-2.17
MEM91RA	29%	42%	54%	53%*	0.001	0.220	0.929	-0.088

MEM88MS	14%	19%	40%	27%*	0.008	0.025	0.126	-1.532
MEM90RS	16%	17%	58%*+	36%*	0.001	0.001	0.009	-2.59
MEM92RS	17%	25%	56%*	42%*	0.001	0.002	0.096	-1.664
MEM93RS	11%	19%	29%	27%*	0.001	0.232	0.8	-0.253
INQ46GA	31%	44%	59%	51%*	0.001	0.307	0.256	-0.311
INQ48TA	38%	35%	46%	50%	0.045	0.299	0.673	0.422
INQ51EA	34%	50%	56%	55%*	0.001	0.539	0.916	-0.105
INQ53ZA	38%	48%	46%	54%*	0.009	0.838	0.329	0.977

INQ66CA	42%	50%	50%	58%*	0.009	1.000	0.342	0.95

INQ47GS	16%	19%	33%	48%*	0.001	0.104	0.099	1.646
INQ49TS	25%	27%	48%	44%*	0.003	0.035	0.627	-0.486
INQ50TS	16%	27%	38%	50%*	0.001	0.275	0.168	1.38
INQ52ES	27%	25%	44%	57%*	0.001	0.053	0.121	1.551
INQ54ZS	31%	29%	54%*	52%*	0.001	0.013	0.842	-0.199
INQ67CS	26%	38%	44%	51%*	0.001	0.533	0.378	0.882
SOL55GA	38%	56%	54%	58%*	0.001	0.838	0.637	0.472
SOL57AA	31%	44%	56%	52%*	0.001	0.221	0.661	-0.439
SOL59OA	32%	58%	46%	55%*	0.001	0.220	0.276	1.089
SOL61PA	40%	56%	44%	55%*	0.013	0.221	0.185	1.327
SOL68RA	40%	65%	48%	52%	0.035	0.414	0.606	0.516
SOL70DA	28%	42%	48%	42%	0.02	0.538	0.477	-0.712

SOL56GS	29%	38%	54%	52%*	0.001	0.101	0.842	-0.199
SOL58AS	32%	31%	50%	48%*	0.001	0.062	0.781	-0.278
SOL60OS	21%	25%	48%	36%*	0.01	0.019	0.161	-1.403
SOL62PS	26%	23%	44%	40%	0.019	0.030	0.646	-0.459
SOL63PS	34%	31%	46%	44%	0.076	0.142	0.805	-0.247
SOL69RS	26%	31%	46%	47%*	0.001	0.142	0.929	0.068
SOL71DS	22%	23%	31%	35%	0.023	0.358	0.654	0.448

ADHD VS CONTROLS

ESD					Sig. Level	Sig. Level	Sig. Level	
EFD+ESD	% for 1s	% for 1s	% for 1s	% for 1s	p < ___	p < ___	p value	Fisher's z
ATN1PA	0%	4%	10%	10%*	0.009	0.371	0.983	-0.135
ATN3FA	1%	4%	14%	13%*	0.005	0.160	0.741	-0.331
ATN5SA	2%	6%	23%	20%*	0.001	0.036	0.732	-0.354

ATN2PS	1%	0%	4%	9%	0.03	0.537	0.824	0.223
ATN4FS	0%	0%	10%	7%	0.038	0.160	0.444	-0.766
ATN6SS	0%	0%	8%	9%	0.015	0.247	0.893	-0.135
ENG7IA	3%	0%	10%	17%*	0.003	0.160	0.324	0.987
ENG9EA	4%	6%	18%	19%*	0.001	0.371	0.686	0.405
ENG16HA	3%	2%	17%	11%	0.042	0.061	0.302	-1.033
ENG19SA	2%	0%	13%	18%*	0.001	0.100	0.36	0.915
ENG22PA	3%	2%	10%	17%*	0.001	0.247	0.324	0.987

ENG24FA	2%	2%	13%	17%*	0.001	0.160	0.436	0.779
ENG26FA	0%	0%	4%	6%	0.06	0.537	0.741	-0.331
ENG28TA	1%	4%	13%	16%*	0.001	0.247	0.623	0.492
ENG8IS	0%	0%	6%	9%	0.015	0.371	0.961	0.049
ENG10ES	1%	0%	4%	8%	0.046	0.537	0.961	0.049
ENG11HS	1%	2%	2%	11%*	0.012	1.000	0.484	0.7
ENG12HS	1%	4%	12%	21%*	0.001	0.247	0.192	1.304
ENG13HS	1%	2%	6%	10%	0.019	0.537	0.824	0.223
ENG14HS	0%	0%	15%	11%*	0.005	0.061	0.491	-0.689
ENG15HS	3%	2%	13%	13%	0.018	0.160	0.983	0.021
ENG17HS	3%	2%	15%	11%	0.042	0.100	0.491	-0.689
ENG18SS	0%	2%	8%	16%*	0.001	0.371	0.324	0.987
ENG20SS	3%	2%	8%	20%*	0.001	0.247	0.102	1.634
ENG23PS	0%	0%	4%	11%*	0.006	0.537	0.584	0.548
ENG25FS	0%	0%	10%	11%*	0.006	0.160	0.961	0.049
ENG27FS	0%	0%	6%	6%	0.06	0.371	0.589	-0.541
ENG29TS	0%	2%	4%	9%	0.015	0.749	0.824	0.223
OPT35NA	0%	6%	38%*	19%*	0.001	0.001	0.017	-2.384
OPT37NA	1%	6%	15%	11%*	0.012	0.247	0.491	-0.689
OPT30DA	0%	0%	6%	15%*	0.001	0.371	0.324	0.987
OPT32DA	1%	0%	4%	22%*	0.001	0.537	0.036	2.1
OPT39CA	7%	6%	23%	21%*	0.001	0.036	0.829	-0.216
OPT43BA	6%	4%	33%*	21%*	0.001	0.001	0.114	-1.579
OPT36NS	0%	2%	15%	21%*	0.001	0.100	0.325	0.984
OPT38NS	1%	2%	6%	13%*	0.005	0.537	0.484	0.7
OPT31DS	6%	0%	8%	33%*+	0.001	0.247	0.002	3.056
OPT33DS	4%	2%	2%	28%*+	0.001	1.000	0.004	2.851
OPT34DS	3%	0%	6%	10%	0.04	0.371	0.824	0.223
OPT40CS	2%	0%	10%	16%*	0.001	0.160	0.398	0.846
OPT44BS	1%	2%	6%	15%*	0.002	0.537	0.324	0.987
OPT45BS	2%	2%	8%	17%*	0.001	0.247	0.261	1.124
EFF72TA	2%	4%	23%	27%*	0.001	0.021	0.577	0.558
EFF74PA	5%	6%	21%	20%*	0.001	0.061	0.949	-0.063
EFF76RA	0%	2%	12%	11%*	0.006	0.061	0.302	-1.033
EFF79RA	4%	4%	35%*	20%*	0.001	0.001	0.048	-1.982
EFF80RA	4%	6%	31%*	19%*	0.001	0.004	0.109	-1.605
EFF81RA	5%	6%	27%*	22%*	0.001	0.012	0.615	-0.503
EFF82RA	1%	2%	10%	4%	0.211	0.247	0.092	-1.683

EFF83RA	5%	10%	21%	19%*	0.001	0.160	0.839	-0.203
EFF84RA	6%	8%	19%	22%*	0.001	0.160	0.616	0.501
EFF85SA	1%	2%	19%	16%*	0.001	0.036	0.621	-0.495
EFF73TS	1%	4%	21%	21%*	0.001	0.036	0.541	0.074
EFF75PS	2%	4%	8%	14%*	0.001	0.537	0.484	0.7
EFF77RS	1%	0%	4%	8%	0.046	0.537	0.961	0.049
EFF86SS	0%	2%	13%	8%	0.025	0.16	0.65	-0.934
MEM87MA	2%	6%	25%	15%*	0.004	0.021	0.119	-1.56
MEM89RA	2%	8%	27%	16%*	0.001	0.021	0.093	-1.676
MEM91RA	3%	6%	38%* +	14%*	0.006	0.001	0.001	-3.347
MEM88MS	1%	2%	6%	10%	0.015	0.537	0.824	0.223
MEM90RS	1%	4%	10%	7%	0.051	0.371	0.444	-0.766
MEM92RS	0%	2%	10%	8%	0.025	0.247	0.586	-0.541
MEM93RS	1%	2%	6%	5%	0.134	0.537	0.444	-0.766
INQ46GA	4%	2%	27%*	25%*	0.001	0.004	0.809	-0.241
INQ48TA	4%	4%	29%*	23%*	0.001	0.004	0.439	-0.773
INQ51EA	4%	8%	25%	26%*	0.001	0.364	0.874	0.159
INQ53ZA	5%	8%	35%*	27%*	0.001	0.002	0.303	-1.03
INQ66CA	6%	6%	33%*	29%*	0.001	0.002	0.601	-0.523
INQ47GS	0%	0%	13%	13%*	0.002	0.100	0.983	0.021
INQ49TS	1%	0%	13%	19%*	0.001	0.100	0.295	1.048
INQ50TS	3%	2%	15%	19%*	0.001	0.100	0.47	0.722
INQ52ES	3%	6%	19%	17%*	0.001	0.100	0.734	-0.34
INQ54ZS	1%	2%	13%	16%*	0.001	0.160	0.623	0.492
INQ67CS	6%	2%	21%	19%*	0.001	0.100	0.839	-0.203
SOL55GA	5%	4%	33%*	22%*	0.001	0.001	0.15	-1.438
SOL57AA	2%	4%	29%*	17%*	0.001	0.004	0.073	-0.794
SOL59OA	7%	6%	33%*	29%*	0.001	0.002	0.601	-0.523
SOL61PA	3%	4%	31%*	29%*	0.001	0.002	0.79	-0.266
SOL68RA	5%	4%	35%*	31%*	0.001	0.001	0.595	-0.531
SOL70DA	2%	4%	21%	22%*	0.001	0.036	0.836	0.207
SOL56GS	1%	2%	15%	15%*	0.002	0.100	0.998	-0.003
SOL58AS	2%	2%	21%	16%*	0.002	0.100	0.422	-0.803
SOL60OS	2%	2%	17%	22%*	0.001	0.061	0.423	0.802
SOL62PS	1%	4%	19%	15%*	0.001	0.061	0.513	-0.655

SOL63PS	1%	4%	19%	17%*	0.001	0.061	0.849	-0.19
SOL69RS	2%	2%	21%	16%*	0.001	0.021	0.422	-0.803
SOL71DS	1%	2%	14%	12%*	0.006	0.100	0.613	-0.506

ADHD VS CONTROLS
SELF-REALIZATION DEV DELAYS

					Sig. Level	Sig. Level	Sig. Level	
	% for 1s	% for 1s	% for 1s	% for 1s	p < ___	p < ___	p < ___	Fisher's z
SR96SAW	9%	19%	23%	18%	0.021	0.615	0.522	-0.641
SR97SAW	14%	17%	19%	15%	0.421	0.789	0.513	-0.655
SR98SAW	15%	25%	21%	11%	0.201	0.627	0.093	-0.679
SR99OAW	20%	35%	25%	20%	0.5	0.267	0.532	-0.639
SR100OAW	19%	33%	23%	22%	0.304	0.256	0.936	-0.08
SR101OAW	17%	31%	25%	17%	0.426	0.496	0.281	-1.079
SR102OAW	20%	38%	23%	20%	0.5	0.119	0.723	-0.354
SR103OAW	25%	38%	35%	22%	0.312	0.832	0.089	-1.657
SR104SAN	7%	10%	21%	17%	0.015	0.16	0.518	-0.646
SR105SAN	10%	19%	31%	20%	0.016	0.157	0.145	-1.459
SR106SAN	21%	35%	38%	20%	0.432	0.832	0.025	-2.237

SELF-DETERMINATION DEV DELAYS

					Sig. Level	Sig. Level	Sig. Level	
	% for 1s	% for 1s	% for 1s	% for 1s	p < ___	p < ___	p < ___	Fisher's z
SD107GO	14%	19%	29%	24%	0.025	0.232	0.522	-0.64
SD108GO	20%	29%	27%	23%	0.306	0.82	0.615	-0.503
SD109GO	19%	40%	29%	17%	0.293	0.283	0.073	-1.794
SD110PL	18%	29%	46%	37%	0.002	0.092	0.296	-1.045
SD111PL	21%	35%	50%	37%	0.007	0.149	0.127	-1.525
SD112PL	21%	35%	41%	32%	0.042	0.529	0.249	-1.154